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Plating

THE MONTHLY REVIEW OF THE AMERICAN ELECTROPLATERS' SOCIETY

MARCH 1948 ★ Volume 35 No. 3

IN THIS ISSUE:

Wage Incentives
Magnetic Measurement of Copper-Nickel Coatings
Polishing and Buffing Aluminum
Copper Plating from Fluoborate Baths
Laboratory Contr[illegible] Baths
Analysis of Alka[illegible]

Complete Contents
See Page 233

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Which is used for Production of

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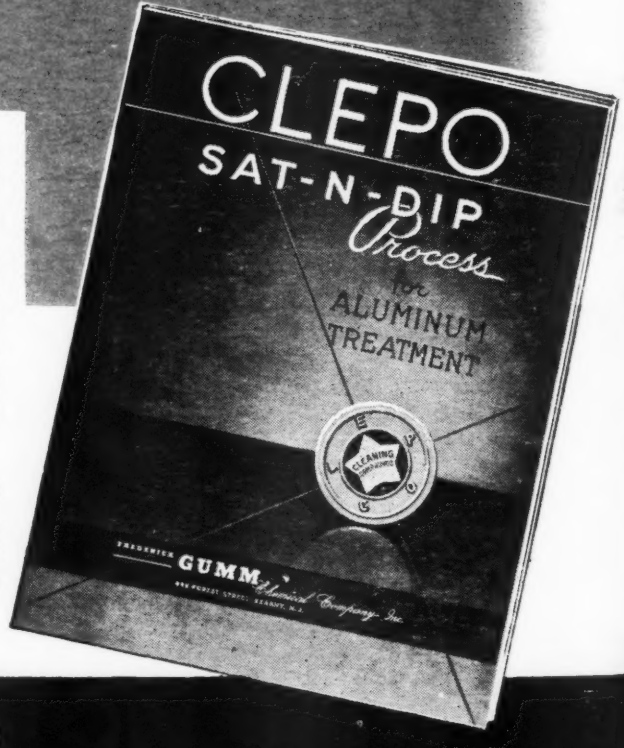
Many manufacturers, who have found that anodizing was too expensive or who lacked the necessary electrical facilities, have changed to the new SAT-N-DIZE FINISH. This finish gives good protection from ordinary abrasion and corrosion, and adds to the attractiveness of the finished product. SAT-N-DIZE FINISH can be produced in natural aluminum or in colors without the use of close laboratory control.

Send us a sample of your product and advise whether color or natural finish is desired. If the product is suitable for SAT-N-DIZE FINISHING, we will process and return for your inspection and approval.



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538 FOREST STREET, KEARNY, N.J.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 200.

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The answers, step-by-step, will come first class post-haste to you

NO OBLIGATION . . . AN ENTHONE RESEARCH SERVICE

Metal Finishing Quiz

- HOW TO *nickel plate upon aluminum.*
- HOW TO *clean and remove rust from steel in one operation at room temperature.*
- HOW TO *color brass a beautiful Antique English color.*
- HOW TO *shed water from metals to prevent staining or spotting during drying.*
- HOW TO *trap fumes from hot sulphuric acid pickles.*
- HOW TO *overcome cloudiness of bright nickel plate.*
- HOW TO *strip alkyd enamels from aluminum at room temperature without attacking aluminum.*
- HOW TO *prepare lead alloys for plating.*
- HOW TO *shorten alkali cleaning time for steel to 15 seconds.*
- HOW TO *remove solid dirt and oil from metals.*
- HOW TO *blacken copper, brass, zinc and steel.*
- HOW TO *make paint stick to brass.*
- HOW TO *get blister free copper and nickel plates on zinc slush castings and die castings.*
- HOW TO *barrel plate upon aluminum.*

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If so Install the

CLEPO SAT-N-DIP PROCESS

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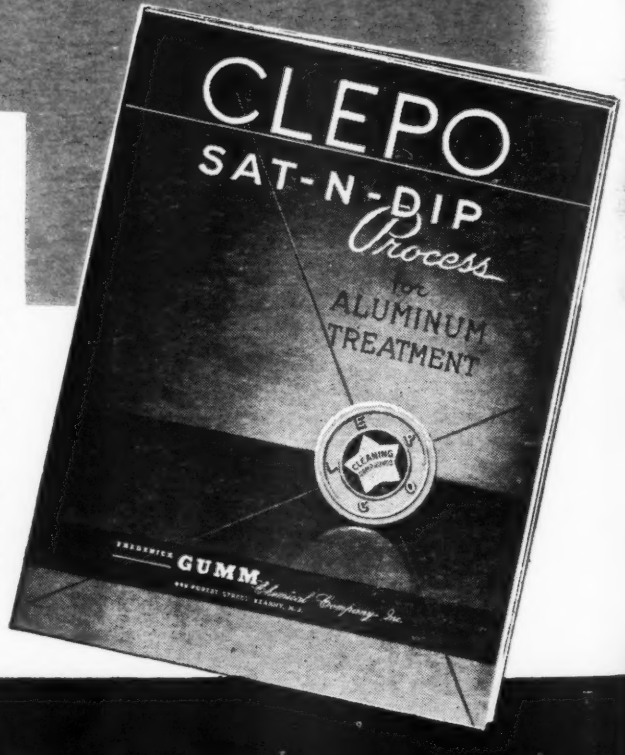

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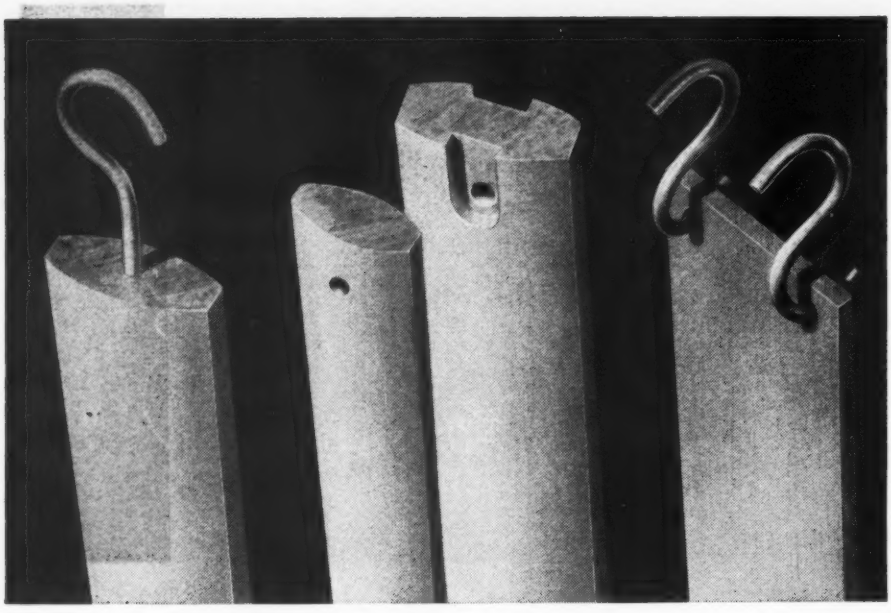

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Branch News

Coming Event

NEWARK BRANCH

SPRING OPEN EDUCATIONAL SESSION

March 5

Robert Treat Hotel

1. *Symposium on Barrel Finishing*
   W. H. JACKSON, The Udylite Corporation, Detroit, Mich.
   "Horizontal Plating Barrels and Auxiliary Equipment"
   DR. GEORGE DUBPERNELL, United Chromium, Inc., Waterbury, Conn.
   "Barrel Chromium Plating"
2. *A. E. S. Research Program*
   MR. KENNETH M. HUSTON, Rustless Iron and Steel Division, The American Rolling Mill Company, Baltimore, Md., President of the American Electroplaters' Society

A discussion period will follow each presentation.

A cordial invitation to attend this annual popular event is extended to all members and friends of the Newark Branch, host to the 35th A. E. S. Convention and Industrial Finishing Exposition in Atlantic City this coming summer.

WILLIAM F. BRUHNS,
Publicity Chairman.

BRIDGEPORT BRANCH

The regular monthly meeting was held on January 9 with thirty members and guests present. EUGENE PHILLIPS officiated as secretary and treasurer during the meeting.

WALTER T. LYNCH, Secretary of the Eighth Annual Regional Meeting, had reported that $75.00 is the share of the Bridgeport Branch from the Regional Meeting earnings.

It was decided to hold a banquet some time during the Spring season.

The Branch voted that it no longer desires to take part in the Annual New England Regional Meeting. The Secretary was ordered to write to the Branches involved and state the reasons for this action.

As a result of the Referendum Vote to increase the per capita tax, the dues of the Branch are $8.50 per year instead of $6.50, or an increase of $2.00 per year effective May 1st.

Published monthly at 5800 N. Mervine St., Philadelphia 41, Pa. Entered as second class matter July 1, 1946, at the Post Office at Philadelphia, Pa., under Act of August 24, 1916. Copyright, 1948, by the American Electroplaters' Society, Inc. Subscriptions: Domestic and Canada, $4.00 per year, 50c per copy; Foreign, $6.00 per year, 75c per copy.

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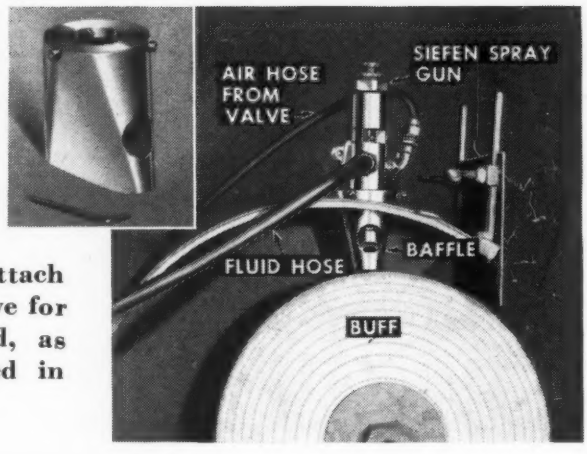
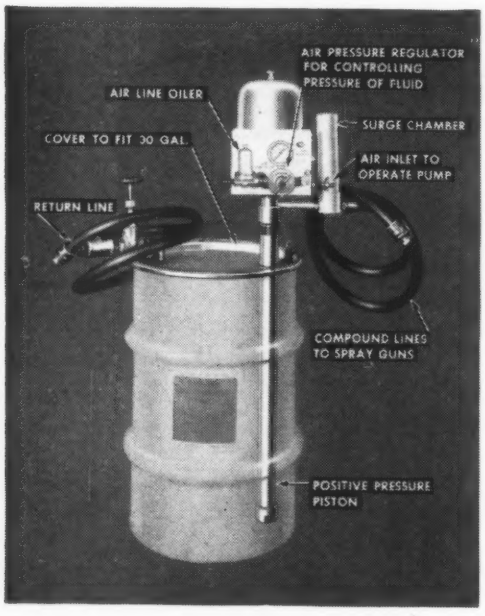
Prevents a lot of overspray and wastes less compound; more goes on wheel. Simple to attach and use. Very effective for Siefen Spray method, as gun can be mounted in almost any position.

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For any number of guns this circulating pump provides liquid buffing compound at proper pressure for each gun. Circulates compound—permits use of larger drums at economical prices—Replaces Pressure tanks.

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PRESIDENT F. B. GOTTHARDT appointed FRANK KALAFUS chairman of the Exhibit Committee and EUGENE PHILLIPS as chairman of the Banquet Committee.

J. G. STERLING,
Secretary-Treasurer.

BRIDGEPORT BRANCH

DR. RALPH A. SCHAEFER, Director of Research of the Cleveland Graphite Bronze Company, Cleveland, Ohio, was the speaker at the Open Meeting and Educational Session on January 16 attended by thirty-eight members and guests. He was introduced by A. J. CHENIS, who served as Technical Chairman.

Dr. Schaefer discussed silver, tin, lead and their alloys, covering briefly their history and dwelling on important points of electrodeposition. These points were brought home with slides showing racks, plating equipment and photomicrographs of the coatings.

Seven conditions have to be considered in the high-speed plating of silver: (1) agitation—with fast agitation 100 to 150 asf can be employed; (2) anode corrosion, (3) carbonate control, (4) temperature, (5) adhesion—the more important, the thicker the deposits; the silver or nickel strike is a very important step in securing adhesion, (6) addition agent—interface structure disappears with the proper addition agent and small crystal structure results; annealing the plate causes the crystals to grow, (7) filtration. Typical silver, lead and tin plating bath compositions were given and discussed.

The phase equilibrium diagram serves as a good criterion in picking the constituents of the alloy and for what to expect from the alloy. An alloy that can be cast readily is sometimes quite difficult or impossible to deposit. The properties of the as-plated alloy may be better, equal to, or inferior to those of the cast metal. It is the job of the researcher to find the alloy which, when plated, will give superior results for the intended purpose. The properties of all plated alloys have a tendency to revert to those of the cast alloys when the plate is annealed.

Dr. Schaefer then briefly discussed the activities of the A. E. S. Research Committee of which he is a member. He finally showed a motion picture entitled, "Bearings by Graphite". It was a most interesting presentation and provoked considerable discussion.

JOSEPH G. STERLING,
Secretary-Treasurer.

BUFFALO BRANCH

The January 9 meeting was highlighted by MR. JOHN DOBSON's talk about "Plating Room Waste Disposal." Mr. Dobson impressed the assemblage with the fact that legislation for control of industrial sewage is moving forward in all

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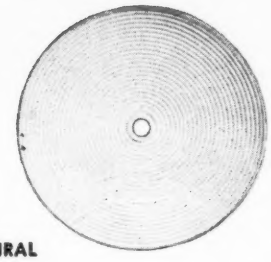

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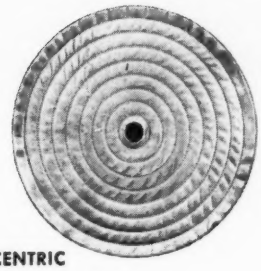

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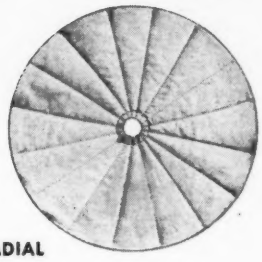

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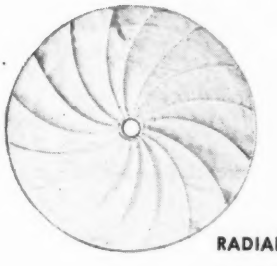

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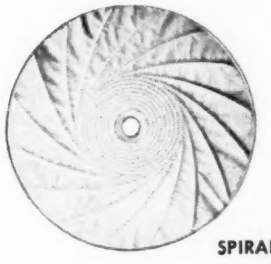

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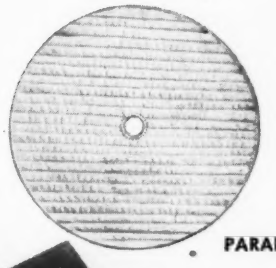

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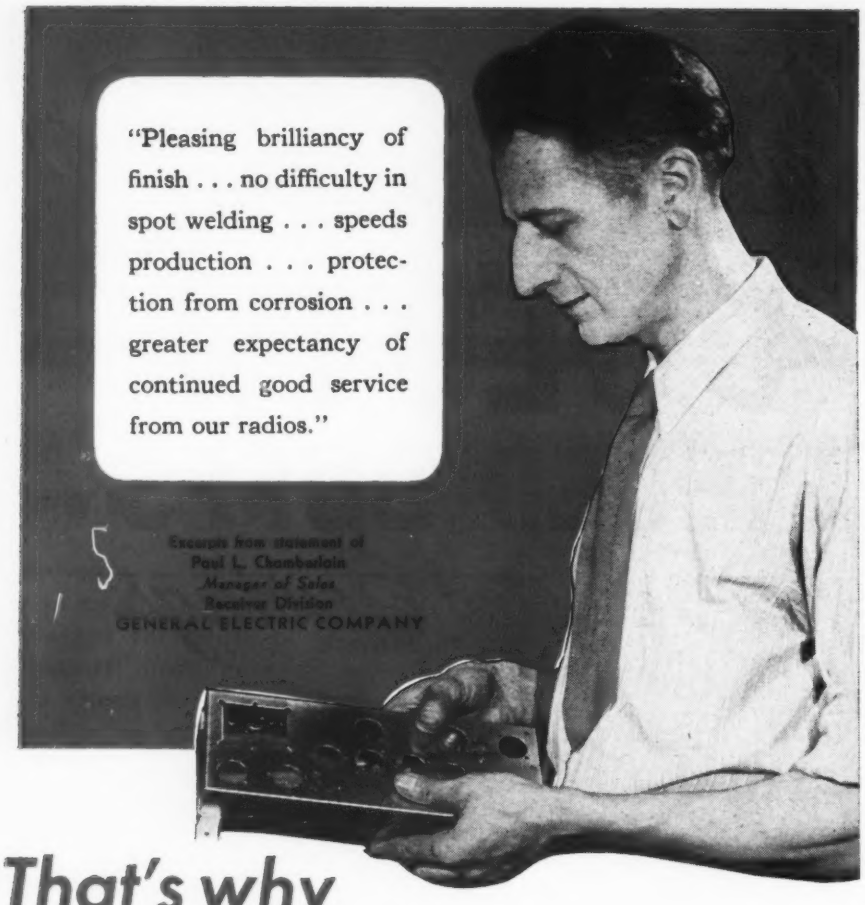
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Paul L. Chamberlain
Manager of Sales
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GENERAL ELECTRIC COMPANY

That's why uses *Luster-on** on its Current Radio Line!

The words quoted above are not ours. They are facts stated by a Luster-on* user! They sum up the reasons why the Sales and Engineering Departments at General Electric chose Luster-on* as the protective bright dip for chassis, speaker shells, and other zinc-plated radio parts — why Luster-on* looks like *good business* to G-E!

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large industrial areas and that a complacent shrug of the shoulders will no longer placate the authorities. He then expounded his experience in the design of disposal plants with particular emphasis upon plating room wastes. The picture he painted was vivid enough to make the listeners realize that they have a problem on their hands.

H. A. FUDEMAN, *Secretary.*

CHICAGO BRANCH

About one hundred and twenty members were present at the December meeting. Special guests were DR. BLUM, MR. CANDEE, DR. KELLNER, DR. SCHAEFER, MR. STRUCKHOFF, MR. WEEG, and DR. WEISBERG, who spoke a few words on the importance and operation of the Research Program and the organization of individual branches to produce support of the program.

MR. JENKINS and MR. STAPLETON of the Chicago Production Show explained the advantages which accrue when the combined technological, scientific, and engineering societies popularize scientific achievements among the general public. The Branch voted to sponsor an educational panel to assist in disseminating knowledge of the plating industry at the Production Show.

The scheduled speaker of the evening was DR. ROY HEATH, who gave an interesting illustrated lecture on the source of chemicals for cleaners and the characteristics of cleaner mixtures and solutions. The points were made that there is no standard soil in the plating industry that can be used for testing cleaners; each soil requires an individual cleaner but economics compel cleaner manufacturers to blend an average cleaner that will remove a large number of soils with moderate efficiency.

The program for the January meeting featured talks by various members of our own branch. MESSRS. GILBERTSON, BUDREAU, HANSEN, and KOCOUR told of the most interesting plating problems they had encountered during their long connections with the finishing industry.

J. H. MONAWECK, *Librarian.*

COLUMBUS BRANCH

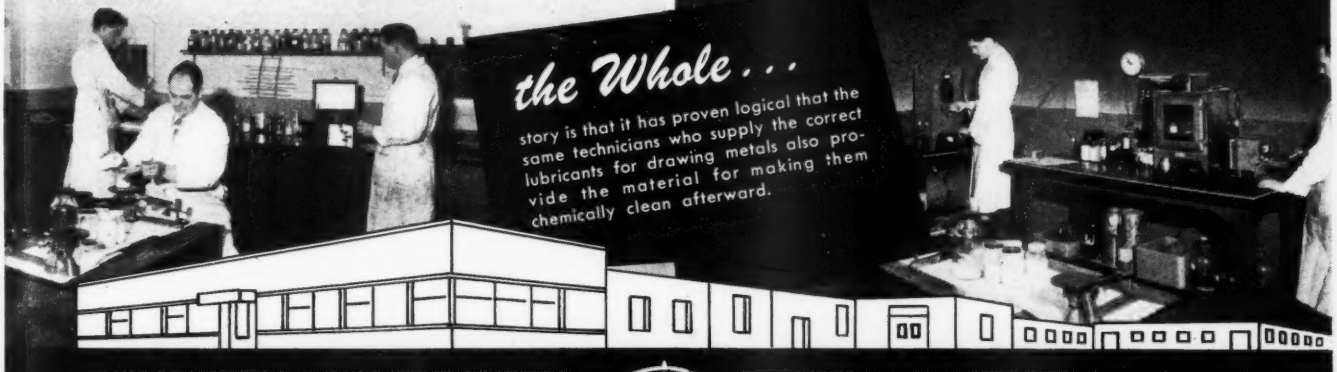
At the January 9 meeting, MR. WILBUR G. HESPENHEIDE was elected Secretary-Treasurer to fill out the term of DR. BERNARD AGRUSS, who is leaving Columbus. Dr. Agruss has accepted a position with the Engineering Research Department of the University of Michigan, Ann Arbor.

Following the business meeting, MR. CLIFFORD STRUYK of the General Chemical Company presented an informative discussion on plating from fluoborate solutions. Mr. Struyk, who has been closely associated with much of the development of the fluoborate plating solu-

HALF + *the other* HALF

of this advertisement is concerned with "SUPERDRAW" metal forming lubricants developed for ferrous and non-ferrous metals in both pigmented and non-pigmented form . . . "SUPERDRAW" products are specifically compounded for 1. Brass and Brass Alloys, 2. Cold Rolled Steel, Enameling Iron, Stainless Steel and Aluminum, 3. Alloys of Steel, Aluminum and Copper . . . "SUPERDRAW" compounds will handle light, medium, and heavy operations . . . may be applied by brush, roller, spray, or dipping.

of our activity concerns NORTHWEST products and processes for chemically cleaning ferrous and non-ferrous metals preparatory to plating, vitreous enameling, painting, etc., each problem involving a specific programing of one or more of the thirty-five standard NORTHWEST Cleaning Compounds including Electrolytic, Immersion, Solvent, Spray, and Water-Wash types . . . *A request on your letterhead will bring a technician to consult you on your drawing and cleaning problems . . .*



the Whole . . .

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tions, described the solutions and conditions for plating copper, zinc, cadmium, tin, and lead as well as cadmium-tin and lead-tin alloys.

The interest of the audience was evidenced by the number of questions put to Mr. Struyk in the period following his presentation.

ARCH B. TRIPLER, JR.,
Second Vice-President.

DETROIT BRANCH

Approximately one hundred and seventy members and guests attended the meeting on January 9. Eleven new members were elected to membership, including two from England: Mr. Harold Silman of Birmingham and Dr. S. Wernick, London, Honorary Secretary of the Electrodepositors' Technical Society.

In the absence of LIBRARIAN GEORGE PILLSBURY, RICHARD FELLOWS presided over the educational session. A very enjoyable sound-color motion picture entitled *Ukranian Winter Holiday* was shown, following which MR. NORMAN HOFFMAN of United Platers, Inc., Detroit, Mich., gave a talk on stripping. He covered the important points to be considered in selecting a suitable stripping bath and discussed the causes of defective work, hazards such as pitting, dissolving base metal, dimensional changes, hydrogen embrittlement and passivation. Formulas for a number of baths were given together with listings of the plated metals which they would strip, and operating details. A number of questions from the floor touching on specific points in the operation were answered during the discussion period.

R. H. DUDLEY, *Publicity Chairman.*

HARTFORD BRANCH

The regular monthly meeting on December 15 was turned into a "Ladies' Night". The overflowing throng of members, wives, and lady friends was entertained by MR. ORLANDO S. PADDOCK, who spoke on "The Romance of Gems", showed a varied collection of precious stones and related their history.

An excellent color movie of particular interest to the ladies, *America's First Silverplate*, had been lent by the International Silver Company; it depicted the evolution of silverware during the last one hundred years. Each lady received a favor to mark the occasion.

Many thanks go to Mr. Paddock and to RALPH MCCAHAN, who, as Chairman of the Educational Committee, had worked hard for the successful evening.

A. J. DANKEVICH, *Secretary.*

INDIANAPOLIS BRANCH

About thirty-five members and guests attended the regular monthly meeting January 7.

GENERAL CHAIRMAN QUENTIN O. SHOCKLEY announced Saturday, May 22, as the date set for the Spring Meeting at the Indianapolis Athletic Club.

The guest speaker was MR. VINCENT R. KELLY of The Udylite Corporation, who spoke about cadmium plating. Optimum bath composition and operating conditions were given, and the pleasing appearance of the coating, the rust protection afforded even after the coating has been scratched through, and the high solderability to cadmium-plated surfaces, such as radio chassis, were emphasized. Mr. Kelly urged the use of a chromic acid-type bright dip for cadmium-plated parts to improve the resistance to finger-staining and corrosion over that provided by other bright dips. Many questions pertaining to the subject were answered.

A short session on general finishing problems followed.

J. MONAGLE, *Secretary-Treasurer.*

LANCASTER BRANCH

The regular monthly meeting was held on January 9 at the Stevens Trade School with twenty-two members and guests present.

WILLIAM FORDNEY was appointed chairman of the Branch Exhibits Committee. A committee to study the revised A. E. S. Constitution and By-Laws was selected and instructed to report its findings to the A. E. S. Constitution Revision Committee by February 1. HARRY HOVIS gave a report on the second Ladies' Night affair, held in December. Three membership applications were approved and two

NEW UNICHROME
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RACK COATING

with 100% SOLIDS

IT'S READY for you now—Coating 218—the last word in rack coatings if you want a job that lasts, saves money and is quickly done. Here's why:

NO THINNERS! You get all *working* material in Coating 218. Nothing to evaporate, nothing to replace, no fire hazard.

FEWER COATS! Only *one* main coat is required over prime and "tie" coat. It goes on *smoothly* overall—in a coating that's far thicker than *eight* coats of solvent types!

QUICKLY APPLIED! Racks are ready in less than ¼ of the time ordinarily needed. You do the job in about 2 hours with Coating 218.

SUPER TOUGH! Elastic Unichrome Coating 218 won't tear or chip, blister or lift. This scuff-proof jacket stays sleek and smooth through toughest plating cycles!

Get the complete details. Write your nearest Unichrome office for our 4-page bulletin

UNICHROME
Trade Mark Reg. U.S. Pat. Off.

RACK COATINGS—Products of
UNITED CHROMIUM, INCORPORATED • 51 E. 42nd St., New York 17, N.Y.
Detroit 7, Mich. • Waterbury 98, Conn. • Chicago 4, Ill. • Dayton 2, Ohio • Los Angeles 11, Cal

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 139.

look what you can do with this M&W finish

SYNPEX withstands the pressure of stamping or forming without cracking or peeling

GOOD adhesion, flexibility and chemical resistance are combined in M&W Synpex to provide an attractive finish that can be stamped or formed without damage . . . that withstands the chemical action of cleaners and electroplating solutions as used in the production of etched name plates.

Synpex is actually a combination lacquer and synthetic enamel. It has the quick drying properties of lacquer — the building, adhesive and durable qualities of synthetics — and is unusually flexible. Available in most colors as metallic or enamel finishes, Synpex can be formulated for practically any baking schedule or may be air-dried.

For complete information about this outstanding M&W finish, write for Technical Data Bulletin 106, or let an M&W representative discuss your requirements with you.

PIONEERS IN PROTECTION
M.&W.Co. 1876

. . . where industry goes with finishing problems

MAAS & WALDSTEIN COMPANY NEWARK 4, NEW JERSEY

Boston 15, Mass. • Chicago 12, Ill. • Los Angeles 34, Calif.
Pacific Coast Division: SMITH-DAVIS CO., 10751 Venice Boulevard, Los Angeles 34
PRODUCERS OF LACQUERS, ENAMELS, SYNTHETICS AND SPECIALIZED PRODUCTION FINISHES

Picture of Progress

Immersion ALODIZING of aluminum aircraft parts for increased corrosion resistance and lasting paint adhesion

Photograph by courtesy of Stinson Division, Consolidated Vultee Aircraft Corporation, Wayne, Michigan.

Alodizing ALUMINUM ASSURES CORROSION RESISTANCE -- TOUGH PAINT BOND -- DURABILITY -- BEAUTY

CHEMICALS ACP PROCESSES

RUST PROOFING AND PAINT BONDING
Granodine *
Duridine *
Alodine *
Lithoform *
Thermoil-Granodine *

RUST REMOVING AND PREVENTING
Deoxidine *
Peroline *

PICKLING ACID INHIBITORS
Rodine *®

The new ACP process using "Alodine"* takes but 2 minutes by immersion—or 30 seconds by spray in a power spray washer. No electricity—no high temperatures—no elaborate equipment—no special skill, necessary.

"Alodine" imparts maximum protection to either painted or unpainted aluminum—provides a durable bond for tenacious finish adhesion.

Alodizing is simple, effective and economical—in large or small, intermittent or continuous production. Additional data available on request.

Pioneering Research and Development Since 1914

AMERICAN CHEMICAL PAINT COMPANY

AMBLER, PA.

Manufacturers of Metallurgical, Agricultural and Pharmaceutical Chemicals

applications were referred to the Board of Managers.

LIBRARIAN CHESTER SMITH introduced MR. S. A. LEWIS of the United States Stoneware Company of New York, who spoke on "Corrosion Resistant Materials Available to the Plater". His talk covered the manufacture, properties and uses of a number of ceramics and plastic coatings. Acid-proof cements and floor construction, tank linings and new types of rack coatings were also discussed. An interesting question-and-answer period followed.

H. CLAY BRUBAKER, *Secretary.*

LOS ANGELES BRANCH

Eighty-six persons attended the regular meeting on January 14.

Three new members were initated. A committee consisting of ERNEST LAMOUREUX, JOHN MERIGOLD and EMMETTE HOLMAN was appointed to write the By-Laws for the Los Angeles Branch.

PRESIDENT HOWARD WOODWARD announced that a Council of Technical Societies had been formed in Los Angeles for the purpose of securing space and facilities for the technical societies in this area. President Woodward and FIRST VICE-PRESIDENT FRANK BUNKER represent the Branch on this Council.

The program was largely devoted to a review of the growth and progress of the Branch since its founding in 1929. MARCUS RYNKOFS, who had arranged it, gave a short resume of early methods of plating, including plating without use of either batteries or machinery in 1908, and described the founding of A. E. S. in 1912 and the Los Angeles Branch in 1929. He then introduced ten Past Presidents of the Branch, each of whom briefly highlighted the events of his term of office. Ernest Lamoureux, Los Angeles' only Honorary Member of the A. E. S., spoke briefly, and CLARENCE THORNTON won a year's free membership in a contest that concluded the program. Cold beer was served afterwards.

DEAN WILLIAMS, *Secretary.*

MILWAUKEE BRANCH

January 9 found the Milwaukee Branch at the Ambassador Hotel playing host to A. E. S. Past President WALTER PINNER at a dinner and meeting.

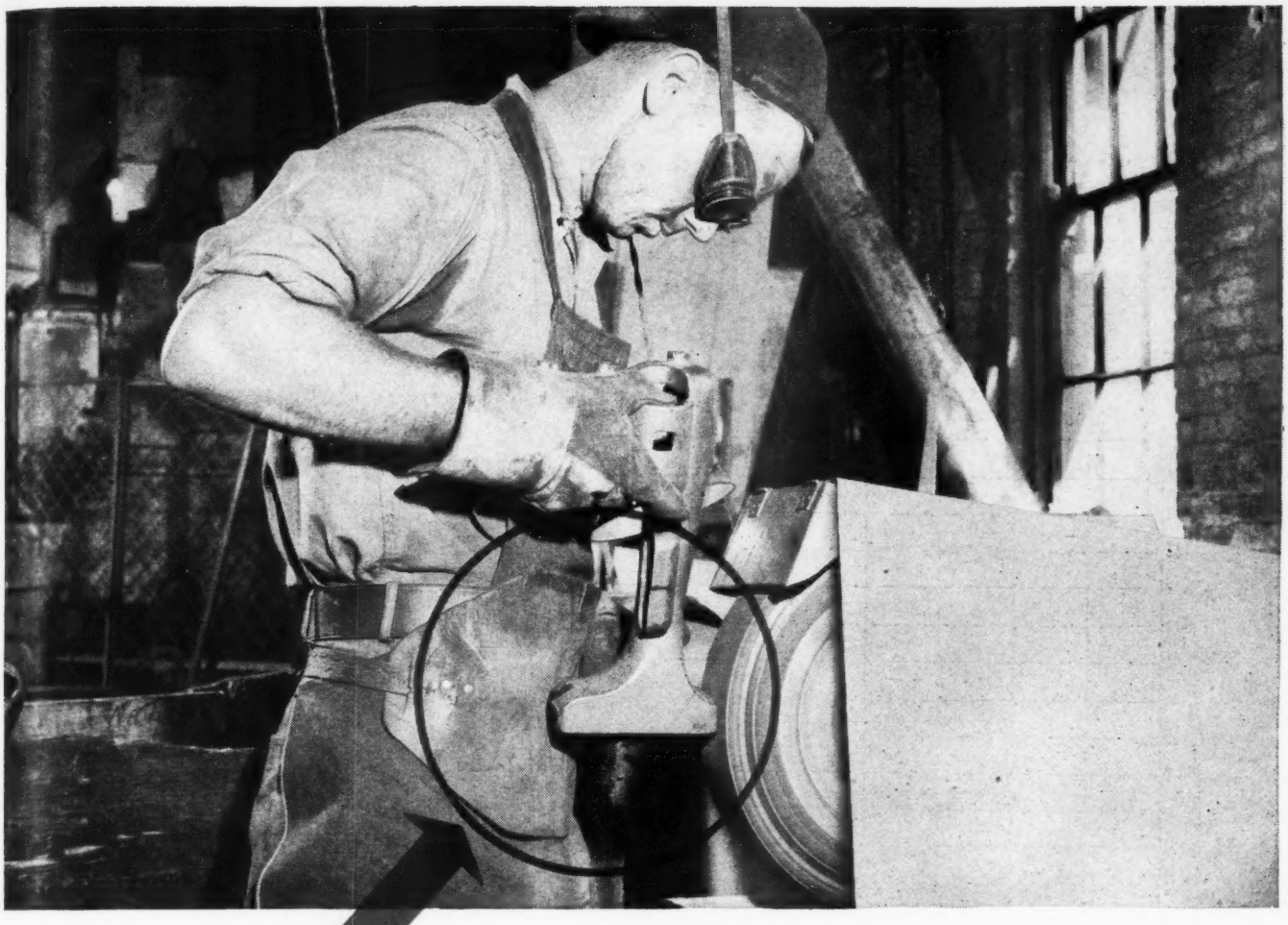
More than seventy members attended the dinner. Mr. Pinner, always a favorite in Milwaukee, spent a couple of hours telling of his trip to England and France. The time went fast, and everyone enjoyed the evening immensely.

JAMES DURNFORD, *Secretary.*

MONTREAL BRANCH

The speaker at the meeting on January 6 was MR. JOHN H. FEELEY, Past President and Honorary Member of the A. E. S., who discussed Silver and Sheffield Plate. He described the origin of Sheffield plate and the manner in which it was first made in 1742. Two samples

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A 141.



Production time cut 74%!

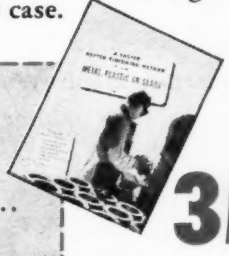
This sewing machine manufacturer formerly used hand filing to remove flash on sewing machine arms and beds. Switching to floor backstands with segment face contact wheels and 3M Abrasive Cloth Belts cut production time on each arm and bed from 12 minutes to 3 minutes, 5 seconds.

This method makes production-line grinding and polishing possible on a wider range of surfaces than ever before, producing uniform finishes at a lower cost per unit in every case.

3M ABRASIVE BACKSTAND BELTS CAN HELP *YOU* REDUCE COSTS

More and more manufacturers are switching to 3M Backstand Belts because of their faster cutting and smoother finishes—regardless of whether surfaces to be finished are curved or flat! Lowered production time, increased output, and fewer rejections are combined with long, economical belt life to produce new savings and a new quality of output.

Further information can be had from your local jobber, or use the coupon below for your free copy of our booklet explaining the 3M Backstand Method.



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3M ABRASIVE BELTS

ANOTHER 3M COMPANY PRODUCT

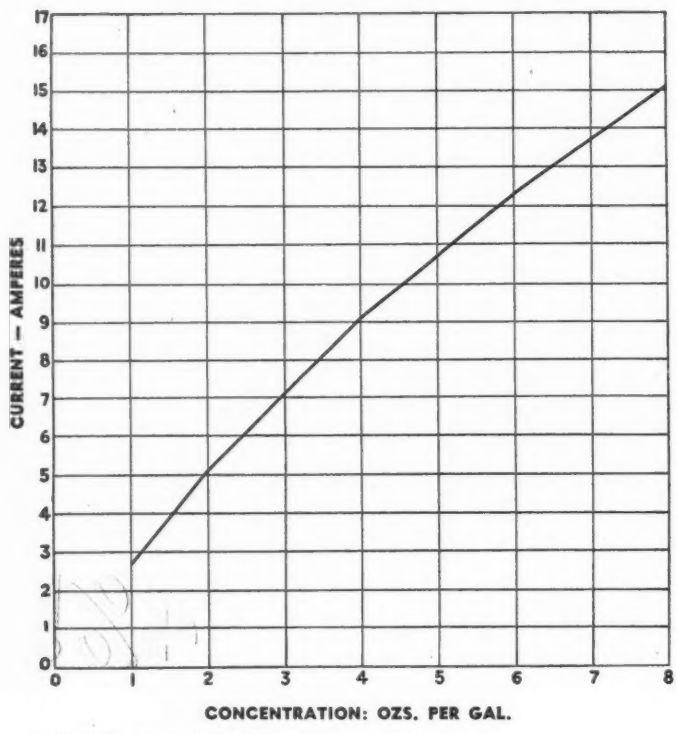
Made in U. S. A. by

MINNESOTA MINING & MFG. CO.

Saint Paul 6, Minn.

For faster cleaning of ferrous parts— WYANDOTTE F.S.

Current-conducting Characteristics of Wyandotte F.S.
(Steel Electrodes, 6 Volts, 180° F.)



Wyandotte F.S. is a heavy-duty reverse-current electrocleaner, especially designed to remove fabricating compounds and "smut" from ferrous parts prior to plating.

Because F.S. is a *balanced* formulation, it assures (1) high conductivity—see chart above, (2) fast and complete wetting and cleaning action, (3) controlled foaming and (4) long life in solution.

Your Wyandotte Representative will be glad to demonstrate the advantages of Wyandotte F.S. or any other Wyandotte Metal Cleaner at your convenience. He's always at your service.

Wyandotte
REG. U. S. PAT. OFF.

WYANDOTTE CHEMICALS CORPORATION
WYANDOTTE, MICHIGAN • SERVICE REPRESENTATIVES IN 88 CITIES

which had been produced around 1780 illustrated the excellent craftsmanship of that time. Mr. Feeley also explained "close plating", a method unheard of in these days, and presented a great deal of data.

Three applicants were elected to membership; there was one application. The attendance was twenty.

WILLIAM L. GLOVER,
Secretary-Treasurer.

NEW HAVEN BRANCH

PRESIDENT ED LUTHER opened the meeting on December 9 by requesting a minute of silence in memory of an Honorary Member of A. E. S. and the New Haven Branch, MR. THOMAS P. BROSNAN, who had died recently. (See obituary in this issue.)

One hundred dollars was donated to the A. E. S. Research Fund.

BILL BRIDGETT of H. L. Judd Company, Wallingford, JOHN OBERENDER, retired from Zapon Company, and JOE SEXTON, retired from Sargent & Company, were voted Honorary Members of the Branch.

TECHNICAL CHAIRMAN HENRY SMITH introduced MR. LEONARD A. CHESWORTH, United Carr Fastener Company, Cambridge, Mass., and his assistant, MR. JONES. Mr. Chesworth spoke on "Production Barrel Plating of Nickel and Zinc", describing a sodium hydride descaling unit for pretreatment, solution and current control, and continuous filtration and purification, all in all an excellent picture of plating in the modern barrel plating units of today. The high quality of the displayed work samples was appreciated by those present.

B. J. GAFFNEY,
Secretary-Treasurer.

NEWARK BRANCH

Two new members were elected and two applications for membership were received at the regular meeting on December 5, attended by forty members and guests.

LIBRARIAN IRENAS introduced MR. DON P. VOLINO, Manager of the Matrix Department, M. G. M. Recording Company, who gave a novel and interesting presentation of his work. He started out by letting the audience hear his voice on a previously prepared recording. An explanation was then given of how the voice is preserved in the plastic disk from which electroplated masters are made. Samples of records illustrated the process. The talk concluded by the playing of a record of an unannounced band, internationally famous, and having the audience guess its identity.

The meeting adjourned at 10:00 P. M., which gave everybody a chance to hear the Joe Louis–Wolcott fight that came on the air immediately afterwards.

SAMUEL S. FREY,
Recording Secretary.

NEWARK BRANCH

The annual Christmas Party was held on December 20. One hundred and

"It says: 'For help with plating, call Du Pont Technical Service.'"

WHATEVER YOUR PLATING PROBLEM, DU PONT TECHNICAL SERVICE OFFERS QUICK, EFFICIENT HELP

Problems are bound to crop up occasionally, even in the best regulated plating operations. And when they do, you can count on Du Pont to work closely with you, to help you find a quick solution.

Whether your problem is large or small, Du Pont has the experience and "know-how" to provide you with valuable advice and assistance. Just call or write the nearest Du Pont office. You'll get competent help from men who are thoroughly familiar with electroplating. And Du Pont Technical Service Men are backed up by Du Pont research and laboratory facilities.

Practical operating manuals giving detailed information on the efficient, economical use and application of Du Pont materials and plating processes can be obtained by sending a letter or by telephoning the nearest district office.

E. I. du Pont de Nemours & Co. (Inc.), Electrochemicals Department, Wilmington 98, Delaware.

DISTRICT OFFICES: Baltimore, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, El Monte, California, New York, Philadelphia, Pittsburgh, San Francisco.

Tune in to Du Pont "Cavalcade of America" Monday Nights—8 P. M., EST, NBC.

DU PONT *Chemicals • Processes • Service*
for **ELECTROPLATING**

DU PONT
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING... *THROUGH CHEMISTRY*

twenty-five members and guests attended the presentation of technical papers and three hundred and fifty crowded the ballroom floor for the evening's gala events.

President Howard Cobb opened the meeting. After Dr. A. K. Graham, A. E. S. Executive Secretary, had given a few words of greeting, Mr. Herbert Head who, with Mr. Edw. Berry, had managed The Industrial Finishing Exposition in Detroit, expressed his wishes for the success of the approaching Convention and Exposition in Atlantic City. Horace Smith spoke on what had been done to insure everybody an entertaining-party, and Mr. George Schore, President of the New York Branch, issued an invitation to the "Big Party" in New York on February 28.

Librarian Zachary Irenas introduced the speakers at the Educational Session and conducted the discussions that followed the presentation of each paper. Mr. Milton Nadel, Superintendent of Finishing at Consolidated Razor Blades, Inc., talked about commercial processes for surfacing articles made of aluminum and its alloys, particularly those for the production of paint and dye bases. He provided his audience with mimeographed outlines of these processes in tabular form. In addition, he summarized the present commercial methods for the preparation of aluminum and its alloys for subsequent electrodeposition. Numerous samples of the coatings, all selected from actual commercial installations, were passed through the audience.

The second speaker, Mr. Myron Diggin, Technical Director of Hanson-Van Winkle-Munning Company, delighted his listeners with a paper and lantern slides on the subject of periodic plating with reverse current. All present had an opportunity to view the electronic gadget which is used to cause the periodic reversals in a plating cycle.

The last speaker, Dr. F. A. Lowenheim, Research Chemist for the Metal and Thermit Corporation, gave an outstanding paper on the plating of uncommon metals. He reviewed some of the patent literature relating to the depositions of aluminum, tungsten, manganese, molybdenum, vanadium and others. To aid in his presentation of his subject, he showed a goodly number of lantern slides with periodic charts of the metallic elements and formulas reported in the literature for preparing plating baths of the uncommon metals.

The social end of the party went into full swing at 7:30 P. M. and lasted to 1:30 A. M. From all reports everybody enjoyed himself.

S. S. Frey, *Recording Secretary.*

NEW YORK BRANCH

Two applications for membership were received and five new members were elected at the meeting on January 9.

The Board of Managers commended Secretary-Treasurer F. MacStoker for the very impressive and for these times amazingly economical Christmas party. Librarian Martin Maher presided over the discussion of the Good and Welfare of the Branch.

Three new applications for membership were received at the regular meeting on January 23. In the near future the meeting place will be changed to the Engineering Society Building at 39th Street between 5th and 6th Avenues. The members will be notified of the date of change.

Mr. William Schneider of E. I. du Pont de Nemours & Company discussed "Copper Strikes" in his inimitable, informal manner. When time came for the members to question the speaker, Mr. Schneider handled them production-line fashion with great semblance to the barbers, "Next!"

The second speaker for the evening was Mr. Ben Flug of the Bart-Messing Corporation, whose subject was "Purification of Nickel Solutions".

Albert Fusco, *Recording Secretary*

PAINT REALLY STICKS

WHEN METAL PARTS ARE THOROUGHLY CLEANED IN A

BLAKESLEE

METAL PARTS WASHER

To assure 100% grease free surfaces for subsequent finishes to automobile bodies, refrigerators, washing machines, toys and hundreds of other products, choose a Blakeslee Metal Parts Washer, especially adaptable to the cleaning of metal parts prior to surface treatment. Blakeslee sprays are designed to reach all surfaces and each machine is "tailor made" to do a specific cleaning job. From our experience in handling every metal piece from small watch parts to diesel engine crankcases, we have been able to build a washing machine designed to do a perfect job and to last for years.

Write for FREE booklet on Blakeslee Metal Parts Washers to answer your particular cleaning problems.

G. S. BLAKESLEE & CO.

BLACOSOLV DEGREASERS AND SOLVENT

NIAGARA METAL PARTS WASHERS

G. S. BLAKESLEE CO., CHICAGO 50, ILLINOIS
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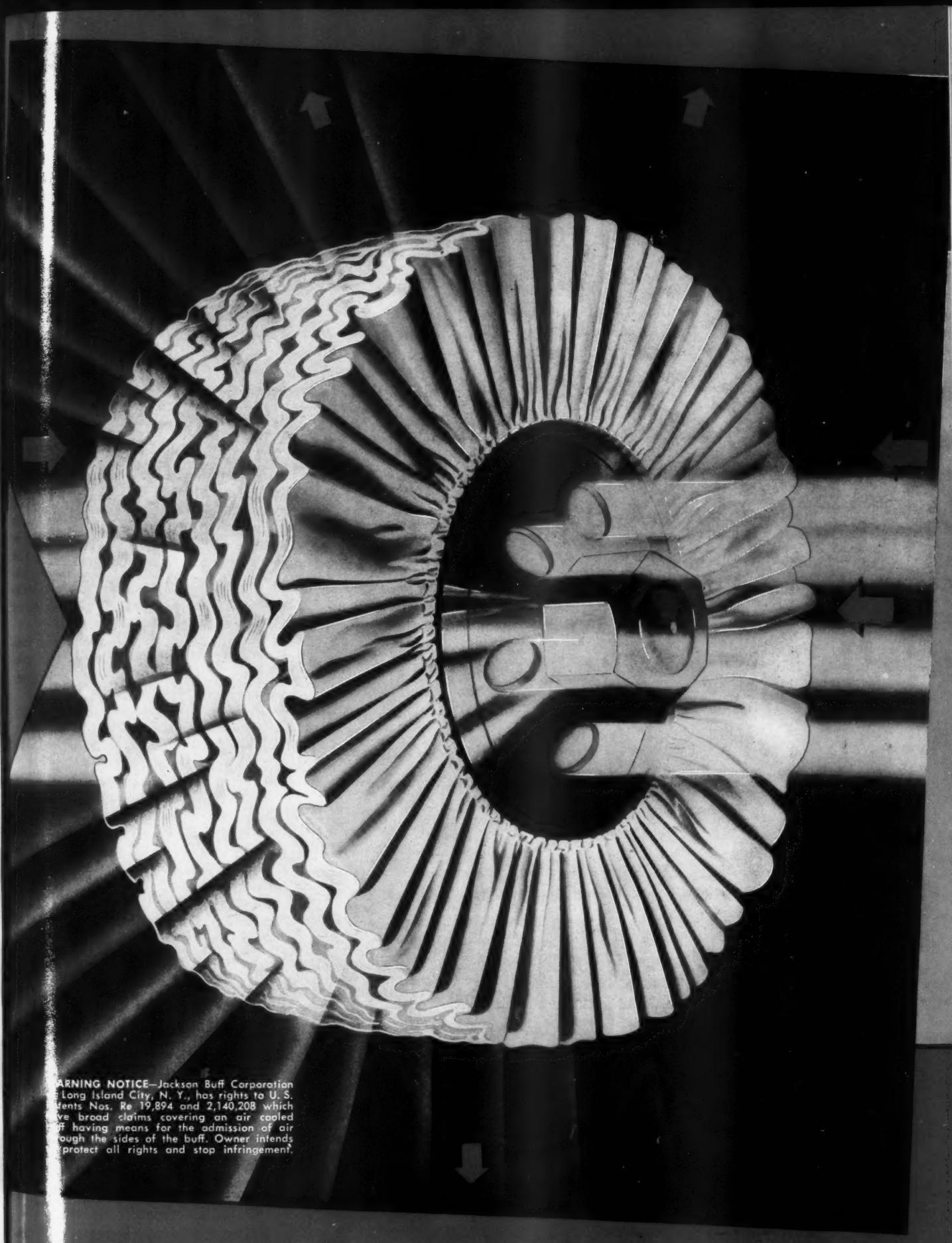


ARNING NOTICE—Jackson Buff Corporation
Long Island City, N. Y., has rights to U. S.
tents Nos. Re 19,894 and 2,140,208 which
ve broad claims covering an air cooled
f having means for the admission of air
ough the sides of the buff. Owner intends
protect all rights and stop infringement.

JACKSON BUFF CORPORATION

21-03 FORTY-FIRST AVENUE • LONG ISLAND CITY 1, NEW YORK

How you can stretch your operating dollars—

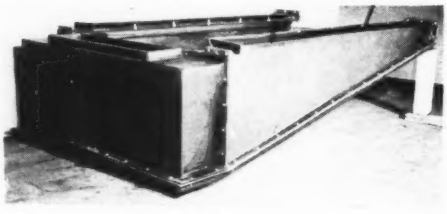
in places where half measures are a total loss

One way is to design all exhaust systems with the thought that casings and ducts have a real job to do—because the fumes, gases and vapors which they handle are practically as corrosive as your solutions.

With correct design and the right choice of materials an exhaust system should last as long as the tank it serves. Made-to-order features pay for themselves in high performance and long life. Illustrated at the left is a lead lined chromic acid tank with lead heating coils, and an exhaust casing on one side only. The relatively small casing is made to function efficiently by the action of the large baffle, which looks like a cover. This device traps and returns the fumes which rise above the aperture opening.

The correct solution of the fume disposal problem was thus achieved at small cost, and with equipment that was quite simple to fabricate. Advantage was taken of special conditions which made such construction suitable.

The sulphuric acid tank casing at the right, built of ordinary steel and then lined and covered with rubber, outlasted a similar casing built of expensive alloy material — many times.



When you want a durable disposal system, Storts can help you by bringing to bear the experience gained through installing hundreds of exhaust systems —all of them different and all of them giving complete satisfaction.

STORTS WELDING COMPANY
INCORPORATED
42 Stone Street Meriden, Conn.
Manufacturers of Welded Fabrications to Specification

PHILADELPHIA BRANCH

The branch had one of its usual dinner meetings at the Hotel Broadwood on January 23.

Four applications were referred to the Board of Managers, and one applicant was elected to membership. There was one out-transfer to San Francisco Branch.

PRESIDENT ORLIK introduced MR. ALBERT HIRSCH, Branch Librarian and Honorary Member of A. E. S., whose subject was "Electroplating During a Lifetime". Starting with the early guessing methods of solution control, he led up to the present highly developed chemical control methods. The many difficulties encountered along the way: meeting government specifications during World War II, electropolishing of steel, stainless steel and aluminum, and modern bright nickel plating were among the subjects dwelled upon.

A. E. S. PAST PRESIDENT GEORGE GEHLING, a member of Philadelphia Branch, died in his sleep during the night of January 26. (See obituary in this issue.)

PAUL MENTZER, SR., *Secretary.*

PITTSBURGH BRANCH

The January meeting of the Branch was held on the 8th. Twenty-eight members and guests were present at the dinner and about fifty at the meeting which followed.

LIBRARIAN GOLDBACH introduced MR. JOHN F. DAYMUDE of the Crosley Division, Avon Manufacturing Company, who spoke on "Electrolytic Corrosion". With the aid of numerous slides he showed the effect of contact between various metals on their resistance to salt-spray corrosion. A number of questions asked by the members were answered.

Three applicants were approved for membership.

H. F. SAYLOR reported for the Branch History Committee and received an offer of assistance from the Secretary.

R. A. DIMON, *Secretary-Treasurer.*

PROVIDENCE-ATTLEBORO BRANCH

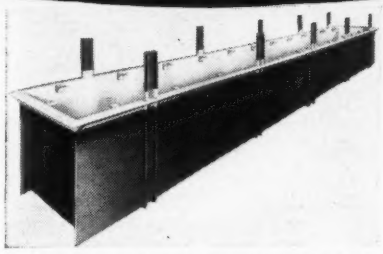
In spite of the heavy snowfall Sunday and the cold weather Monday, thirty-five members and guests turned out for the regular January meeting to hear MR. HENRY STROW of MacDermid, Incorporated, speak on bright copper. In the first portion of his talk he outlined the development of bright copper plating solutions and specified the necessary requirements. The latter half was concerned with remedies for usual troubles encountered in bright copper plating.

MR. J. B. ARTHUR, Director of the Rhode Island State College Extension Division, was present and described briefly but in some detail the plans for a full set of courses in electroplating. The first course will start February 19.

EDWARD A. PARKER, *Secretary-Treasurer.*

FOR FURTHER INFURMATION, USE READER SERVICE CARD; INDICATE A 149.

GET COMPLETE INFORMATION ON THESE ARCO PRODUCTS FROM YOUR LOCAL PLATING SUPPLY HOUSE

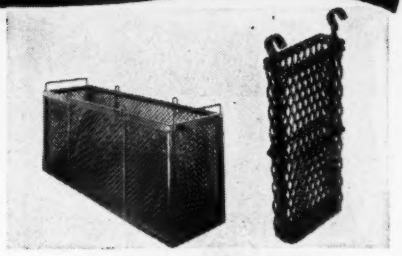


PLATING AND PICKLING TANKS

Any size or shape fabricated and/or rubber insulated for plating, pickling, storage, mixing, aging and chemical processing. Seamless or sheet lined.

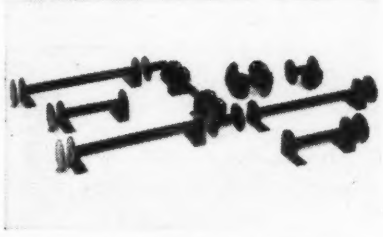
GRIDS FOR TANK BOTTOMS

Seamless rubber covered mesh or expanded metal with channel iron frame and supports. Protect rubber lining of tank from damage caused by falling sword ends, racks and sharp work pieces. Lengthen tank life.



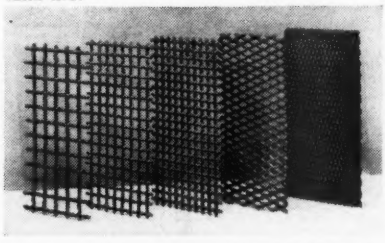
DIPPING, HANDLING, ANODE BASKETS

All types of baskets, trays, containers fabricated and/or covered with rubber or synthetics. Protect parts and eliminate corrosion.



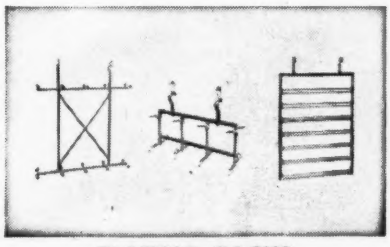
AIR AGITATION SYSTEMS

Perforated pipe semi-hard rubber covered. Aperatures drilled through rubber filled perforations. Air flows through rubber. Flanges sealed and assembled with plastic bolts. No metal exposed.



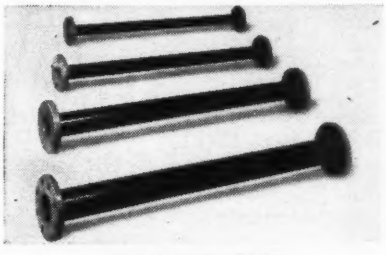
INSULATED PARTS SEPARATORS

Woven wire, expanded or perforated metal, seamless rubber covered for use in tote pans, pallets or conveyor baskets. Protect plated, painted and precision finished surfaces.



PLATING RACKS

Regardless of the nature of the operation, cleaners through chrome, a tough, flexible, durable rack insulation of hard to soft natural or synthetic rubber or plastic materials fabricated and/or covered to your specification.



FLANGED PIPE

For transfer of corrosive solutions, acids, alkalis, minerals, etc. Steel, cast or wrought iron pipe and fittings. 1½" I.D. up.

UNBREAKABLE UTENSILS

Perforated metal seamless rubber covered. Lining and outside covering are fused through perforations to prevent rubber separating from metal. The only really safe utensils available.

HANDY TANKS

Steel storage drums lined and covered with seamless rubber. No breakage, solution loss or acid hazards. Used for solution make-up, dip, pickle, strip, lab and experimental. 10, 15, 30, .55 gallon.

HEADQUARTERS FOR RUBBER INSULATED PLATING EQUIPMENT

AUTOMOTIVE RUBBER COMPANY, INC.

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YOU CAN'T MISS . . .

when you specify HARRISON

4A

buffing and polishing compounds!

Spray and Dip Compounds for Cutting and Mirror Finishing. Double-Header Compounds in sizes 150-180-220-240-320

• If your aim is faster cutting, increased production, greater economy . . . set your sights on Harrison 4-A Products. Our 25 years of experience exclusively with buffing and polishing compounds are your assurance of the *right* compound for the *right* metal . . . and of uniform, dependable quality as well. We will be glad to advise you on special problems and furnish samples of compounds that will meet your needs.

HARRISON & CO., INC. • HAVERHILL, MASS.

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Meet FLAT•TOP. . .

THE ANODE YOU KNOW IS ZINC

FLAT • TOP is a *different* zinc anode. Its difference in shape alone is going to end some of the worst problems in your shop. But FLAT • TOP has 6 IMPORTANT ADVANTAGES —

FLAT • TOP'S distinctive appearance makes recognition *sure*. Stops mixing zinc with cadmium or tin balls. Eliminates dumping, saves time and material.

FLAT • TOP'S area is 20% to 25% greater than a ball. More weight per anode reduces loadings, cuts labor.

FLAT • TOP'S original shape retained — even when dissolved to 25%. A glance avoids incorrect reloading of the anode basket.

FLAT • TOP is 99.99% *pure* zinc, highest purity anode zinc available. Not readily obtainable from general smelting sources.

FLAT • TOP is smooth. No gates or flash to hang on basket wires.

FLAT • TOP'S tight keg prevents contamination from second hand containers. 250 lb. keg is easily stacked, rolled and trucked.

Yes, FLAT • TOP *saves — in every way — yet is the SAME PRICE as troublesome ball anodes in fragile bags or battered drums. Sold by qualified metal finishing supply houses only.*

METAL FINISHING EQUIPMENT

Wagner BROTHERS INC.

POLISHING AND PLATING MATERIALS

425 Midland Avenue — Detroit 3, Michigan

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 152.

ROCHESTER BRANCH

The featured speaker on January 16 was MR. HENRY STROW, Chief Chemist, MacDermid, Inc., Waterbury, Mass., who gave an unusually comprehensive talk on "Bright Copper Plating" and answered numerous questions by the members. An attendance of around forty members and guests in zero weather was a compliment to the speaker.

Three new members joined the Branch and three membership applications were received. There was one in-transfer from the Newark Branch.

RAY BERGHOLD was commended for a fine job of taking care of the details of the Christmas party held at the 40 and 8 Post, which was attended and enjoyed by forty couples.

The Spring Regional Educational Meeting will be held on Saturday, April 24.

JAMES E. WEAVER, *Secretary.*

SAN FRANCISCO BRANCH

Seventeen members attended the meeting on January 15.

J. R. PATTENGER was instructed to make a study of the draft of the A. E. S. Constitution submitted by MR. CLYDE KELLY, and to forward any comments deemed necessary.

Because there seems to be a dearth of speakers in the Bay Area qualified to talk on plating subjects, it was decided that the Librarian should try to secure a speaker on some other subject of interest to the members and their guests whenever necessary.

JACK HITE, *Secretary-Treasurer.*

SPRINGFIELD BRANCH

The January meeting was held on the 26th in Hotel Charles.

The 1949 Regional Meeting will be held in Springfield.

JOHN HORRIGAN introduced MR. MYRON B. DIGGIN, Technical Director of Hanson-VanWinkle-Munning Company, Matawan, N. J., who gave an interesting talk on "Engineering Applications of Electrodeposition of Metals". Chromium, nickel, copper, tin and iron plating were included. Slides illustrated the different points of interest. A short discussion followed.

LAURENCE R. FOUNTAIN,
Secretary-Treasurer.

ST. JOSEPH VALLEY BRANCH

There were thirty-seven present for the dinner and forty for the business and technical session on January 7.

MR. JAMES HEDGES presided in the place of PRESIDENT MCDOWELL, whose wife was ill. Four new members were elected, and one new application was received.

A Constitutional Committee consisting of H. J. WIESNER, Chairman; JAMES HEDGES, L. E. WEEG, R. D. WYSONG, and WILLIAM MCDOWELL was appointed

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by Vice-President Hedges to study the newly drafted Constitution and make suggestions.

LIBRARIAN PETERSON introduced MR. H. J. MCALEER, President of the Formax Manufacturing Company, Detroit, Mich., who spoke on "Polishing and Buffing". The importance of a good layout and good engineering in the polishing and buffing rooms was stressed in the earlier portion of the talk. The latter part was devoted to a discussion of the factors and constituents required to produce good buffing compounds. Mr. McAleer's excellent talk was followed by a question-and-answer period.

HAROLD J. WIESNER,
Secretary-Treasurer.

TOLEDO BRANCH

Twenty-eight members attended the regular meeting on December 4 in Commodore Perry Hotel.

If the plans for a course in electroplating at the University go through, classes will be held on Monday nights from 6:55 to 9:35 P. M. Registration will be held on January 29 and 30. The cost will be $12.00 per member per semester plus breakage fee; veterans free.

Two applicants were received into membership.

MR. PAUL DRESSEL, a member of the Branch, gave a very good talk on "Modern Electroplating" as it is done at the Dura Manufacturing Company in Toledo.

G. BERGEMAN, *Secretary.*

TORONTO BRANCH

At the January meeting, which was attended by sixty-eight members and guests, PRESIDENT BLANDY ran through the business meeting in short and efficient order. This included four applications for membership, a financial report and a few well-chosen words on the subject of dues in arrears.

More information was given on the Ontario Regional meeting to be held on May 15 at the General Brock Hotel in Niagara Falls, Ontario. Apparently this is going to be thoroughly worthwhile, both educationally and socially. Since the General Brock Hotel isn't any too large, reservations for rooms should be made early.

The speakers for the evening, MESSRS. DICK RICHARDS and FRANK GRIGGS, both of Canadian Hanson and Van Winkle, had promised us an unbiased discussion of the merits of motor-generators and rectifiers. They lived up to their promise and gave us the sanest talks on the subject we have had yet. Dick Richards spoke on the mechanical characteristics and Frank Griggs covered the subject of installations in various plating rooms. These talks were considered to be of so much general interest that the speakers were asked to have them mimeographed for local distribution.

KERGAN WELLS.

Contents

PLATING - the Monthly Review of the American Electroplaters' Society

Volume 35 - Number 3 - March 1948

Wage Incentives in the Plating Room 236
Frank K. Savage

A New Method for Magnetic Measurement of the Thickness of Composite Copper and Nickel Coatings on Steel 242
Abner Brenner and Eugenia Kellogg

Polishing and Buffing Aluminum 248
C. J. Hinton

Electroplating from Fluoborate Solutions, I: Copper .. 252
Karl S. Willson, A. H. DuRose, D. G. Ellis

Notes on Laboratory Control of Plating Solutions 257
R. B. Saltonstoll

Determination of Impurities in Electroplating Solutions, VIII: A. E. S. Research Project No. 2 260
Earl J. Serfass, W. S. Levine, J. E. Oyler

Monthly Features:

Branch News	208
Editorial	235
Book Review	265
The Question Box	267
Abstracts	268
Patents	274
Industry News	281
Personals	285
Equipment and Supplies	286
New Literature	289
Membership Report	295
A. E. S. News	299
A. E. S. Directory	302
Advertising Index	305
Future Meetings	306
Letter from the Editor	306

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Published

Monthly at 5800 N. Mervine Street, Philadelphia 41, Pa. Official Organ of the American Electroplaters' Society. Editorial, Advertising and Executive Offices: P. O. Box 168, Jenkintown, Pa. Phone: Ogontz 4663. Subscriptions: Domestic and Canada, $4.00 per year, 50c per copy; Foreign, $6.00 per year, 75c per copy.

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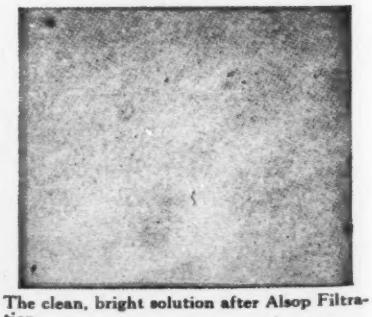

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Editorial

MARCH 1948

TRENDS IN CLEANING FOR PLATING

IT IS NOT very many years ago that most articles were difficult to clean in preparation for plating, a situation which frequently resulted in a high percentage of rejects because of visibly poor adhesion between the plate and the base metal. Caustic soda, soda ash, trisodium phosphate, sodium cyanide and soap were the chemicals used in the cleaning solutions; electrolytic cleaning was almost all cathodic, possibly with a short reversal toward the end; racked parts often had to be scrubbed by hand, and even then adhesion of the plated coating left much to be desired. Perhaps most successful was the tumble cleaning of small parts in the oblique barrel.

In the meantime great strides were being made by the suppliers to the laundry industry. New cleaning chemicals were being developed with higher detergent value and greater ability to soften water including complex silicates and phosphates, and soap substitutes appeared with higher penetrating, wetting and emulsifying power than the old soaps. The mechanism of soil removal from fabrics was studied intensively and became better understood, especially after adequate methods of tests for evaluation had been developed. The dry cleaning industry, because of the hazards accompanying the use of flammable solvents, turned to chlorinated solvents such as trichlorethylene.

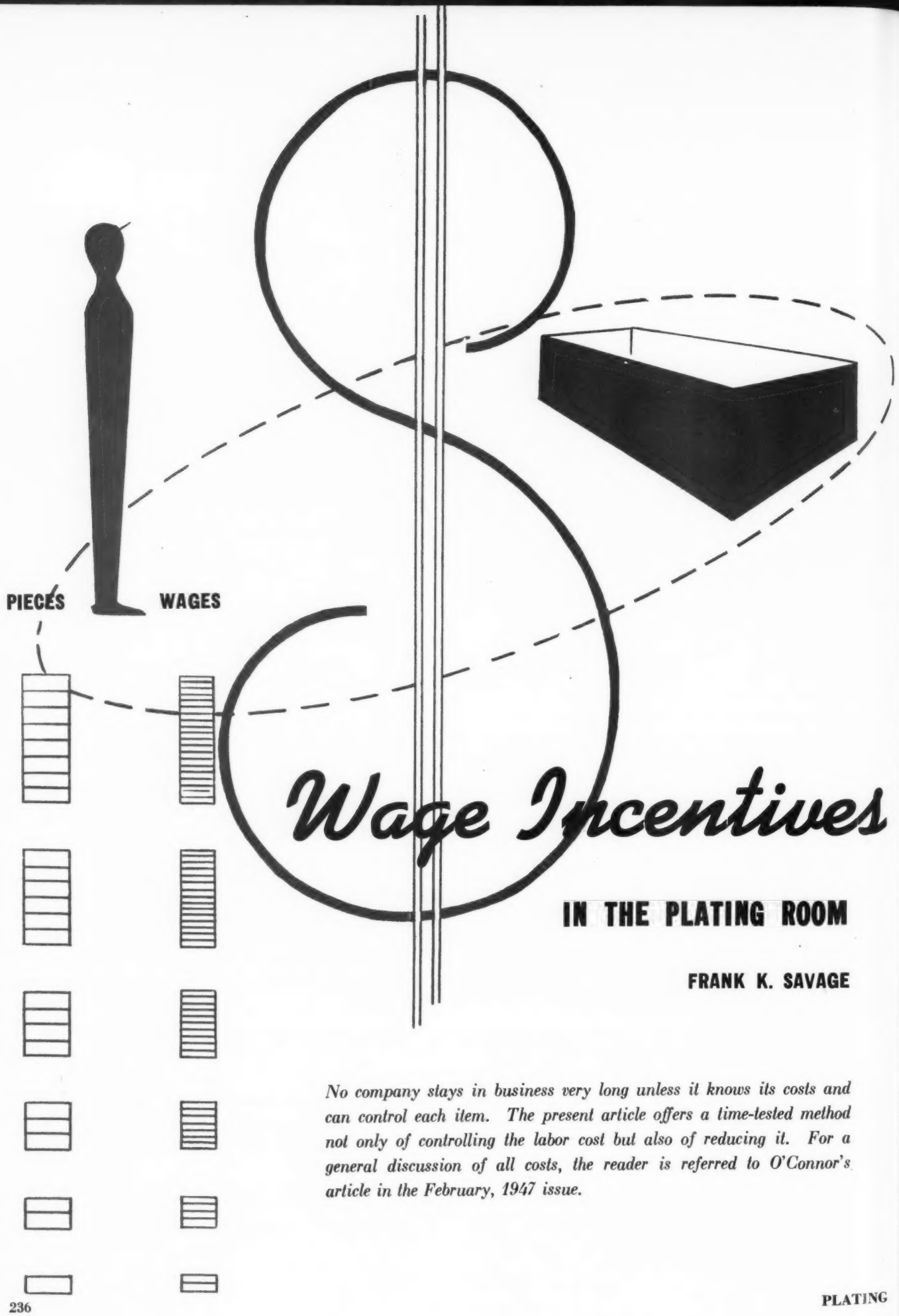
Spurred by the need for more reliable cleaning methods which would permit greater automatization of plating, the metal cleaner manufacturers went to work with these new materials and developed new, more efficient cleaners. Where passivation is not a factor, anodic cleaning has largely replaced cathodic cleaning, with attendant improved removal of smut and reduction of deposition of films of foreign matters. Special equipment was built to make use of the chlorinated solvents for pre-cleaning, including smut removal.

There is now considerable interest in the use of acid baths containing organic "wetting agents" to obtain highly uniform action and, at the same time, to dislodge oils and greases. A beginning has been made of studying the chemical reactions between cleaning solutions and base metals and the nature of the films which form during these reactions. The functions of bath constituents in the physical removal of surface contaminants and the phenomena which occur at anode and cathode during electro cleaning have also received some attention. Attempts have been made to devise adequate tests for cleaning efficiency with particular interest having been displaced in adhesion tests.

Thus, while much progress has been made in the past few years in improving cleaning and thereby the quality of plated coatings, much remains to be done before cleaning problems can be solved on an engineering basis rather than by cut-and-try. Recent indications of the role of cleaning in the behavior of stressed coatings during corrosion lend emphasis to this need.

The fundamental investigations of factors involved in cleaning of metal surfaces and in internal stress in plated coatings as embodied in Projects No. 12 and 13 respectively of the Research Program of the American Electroplaters' Society should go far toward supplying valuable information.

Gustaf Soderberg



Wage Incentives

IN THE PLATING ROOM

FRANK K. SAVAGE

No company stays in business very long unless it knows its costs and can control each item. The present article offers a time-tested method not only of controlling the labor cost but also of reducing it. For a general discussion of all costs, the reader is referred to O'Connor's article in the February, 1947 issue.

The author is an outstanding representative of the modern school of platers, with a record of accomplishment not only in electrochemical development work but also as superintendent of plating and general manufacturing. He is now Vice-president of Standard Plating Rack Company in Chicago (see the Personals column in this issue).

A WAGE INCENTIVE may be defined as a device or system whereby an individual working singly or in a group may increase his earnings by producing more in reference to a set standard. Wage incentives in plating rooms are not fundamentally different from those in any other production effort, although some systems are necessarily designed to fit a specific set of conditions. Special conditions are found in plating rooms as well as in any other manufacturing department and must be met by special and sometimes unique devices.

Requirements

A wage incentive system should fulfil as nearly as possible several requirements.

1. It should provide a true incentive, paying in direct proportion to effort. After a value has been placed on a unit of production, the operator should be paid at the same rate for all units produced. In the past there have been proposed and used systems which paid operator performance on a sliding scale, depending upon the number of units produced. The author strongly feels that the incentive system should recognize that each unit of production has the same value.

2. It should be easy for an operator to figure his hourly or daily bonus under the incentive plan. Involved systems which require a skilled mathematician to calculate the earnings lose much of their effectiveness. An operator with only ordinary arithmetical skill should be able to compute his earnings quickly so as to be able to pace himself and thereby actualize the basic principle of more pay for more work.

3. The rates should be set so that there is an appreciable differential between the base day rate for the job and the possible hourly incentive pay in case of extra effort.

4. Some guarantee should be made against unfair rate cutting. It should be understood that a bonified change in method which increases or decreases operator time should promptly result in adjustment of the rate. Failure to adjust rates promptly when changes in operation occur, failure to set new rates promptly, and unfair cutting of established rates constitute possibly the greatest causes of failure of incentive systems and certainly are the main sources of labor dissatisfaction in connection with incentives.

5. An operator's earnings under an incentive system should be incorporated in his pay for the pay period in which it is earned. A waiting period minimizes the effectiveness of the system.

6. The method of rate setting should be standardized and skilled observers should be employed. Rates should be set only after the proper motion study has been made to insure that proper methods, tooling, and arrangement of work place are being used and that quality requirements are being satisfied.

Types of Incentive Systems

Many types of incentive systems have been proposed and employed in plating rooms in the past. A few are described here in greater or lesser detail.

1. *Individual direct bonus plan.* In this plan a value is placed on the pieces produced. The operator is paid for each piece at the same rate regardless of

the number produced. The method of expressing the value varies from plant to plant and depends somewhat on the accounting practice. The most common terms in which the piece-work rate is expressed are: dollars per piece, per one hundred pieces, per pound, or per one hundred pounds. Some plants have found it advantageous to express rates in earned hours per piece, per one hundred pieces, or per unit of weight.

The individual direct bonus plan is considered by many experts to provide the best type of incentive because it fulfils the greatest number of basic requirements: it pays directly for pieces produced; it is easy for the operator to know at all times what he is making; the operator is on his own and not dependent on others; and it permits easy figuring of costs for estimating or accounting purposes.

2. *Group bonus plan.* This plan in its simplest and best form is the same as the individual bonus plan except that all members of the group participate in the earnings resulting from the production of the group. There are many modifications, particularly in the way the earnings of the group are distributed: a lead man or group leader, where he exists, may receive a larger proportion of the group earnings than the other members of the group; learners or inexperienced members of the group are frequently paid a smaller proportion than the balance of the members until they have become skilled.

This plan has the disadvantage that the operator is less on his own and more dependent on others for his earnings. Another drawback is that it is more difficult for the individual operator to calculate his earnings.

One advantage of a group bonus plan is that it can be used in some cases where an individual bonus plan would be impractical, e. g., where the work of each operator is clearly dependent on that of others in a group. Also, the group bonus plan is more or less self-policing in that members of a group will not tolerate loafing or non-performance on the part of one individual because it affects the earnings of each individual in the group.

3. *Indirect bonus plans.* Some of the many other incentive plans used in the past have been based on quantity of goods manufactured, on quantity of goods shipped, on inspection data, on departmental or divisional operating statements, or on net or gross profits of a department, a division, or the entire business. These plans have compensated employees in cash awards, stock bonuses, bonds, and even in more intangible ways such as vacations with pay or insurance policies.

Types of Plating Departments

In plating rooms there are some unique conditions which should be studied before an incentive plan is formulated and put into operation. On one hand, one may find a single plating tank and a single operator who wires, cleans, plates and unwires the work as well as scratchbrushes, polishes, buffs, maintains solutions, makes analyses and does the entire miscellany of work necessary in even the smallest plating plant. On the other hand, the plant may be so highly developed on a mass production basis that the operators are really only material handlers transferring work from one conveyor to another; conveyor speeds are regulated and racking is standardized so that there is much less dependence on the individual effort and ingenuity.

Incentives are decreasingly effective as the plant is mechanized. The more that output depends on individual operator effort, the more effective is an incentive. By this is not meant that incentive plans are not successful and desirable in mass production plants, only that they are less effective than in shops with less mechanization.

In the following paragraphs the author has attempted to explain how incentive systems may be set up and operated successfully in plating rooms, special attention being given to some of the unique conditions found therein.

Incentive Plans in Plating Departments

In the very small plating room where only one or two operators do all the work and one acts as foreman, chemist, rack maker, and so forth, perhaps the simplest and most comprehensive incentive is a bonus paid on the dollar value of the material plated or the number of pieces or pounds turned out. Additional elements can be superimposed on this system, with rewards for quality as evidenced by rejects, strippers, or returned work and rewards for cost control as indexed by supply bills, maintenance and utility bills.

In larger plating rooms frequently the same individual racks or wires the work and plates it. In these places it is possible and customary to set individual piece rates for the entire operation. Where separate individuals do the wiring or racking, it is customary to break down the operations, making separate operations and piece rates for the wiring or racking and sometimes even for the unwiring or unracking. Where conditions will permit, separate rates for each operation, such as degreasing, wiring or racking, cleaning, plating, unwiring or unracking, are perhaps the best because of the greater ease of studying and evaluating individual operations. Much greater operator flexibility is also made possible.

Difficulty is frequently encountered with piece rates for the plating operation proper. The actual plating time while the work is in the tank usually is not allowed in setting a piece rate. The problem becomes one of balancing the operator's time and the

amount of work so that he is constantly loading or unloading. Where this is impossible due to lack of tank capacity or lack of diversification of work, he can generally be assigned other work to fill in time, such as racking, degreasing, or rack repair, each of which can also be put on an individual piece rate basis. Admittedly, these arrangements require ingenuity on the part of the supervisor, close follow-up, and constant supervision but actually no more than a good supervisor should exercise in the absence of piece rates.

Semi- or full-automatic conveyor operation makes incentive somewhat less effective. In many places, work is racked or wired by separate operators, in which cases individual piece work rates may be set. The conveyor tenders usually have little control over the speed of the conveyor itself. The problem becomes one of keeping every hook or carrier position full. A single operator is paid a bonus on an individual piece-work basis, two or more operators divide a group bonus for full operation of the conveyor; for each empty carrier arm that much is deducted from the possible top earnings. Because rackers, handlers and, in special instances, other individuals may profoundly affect the efficient operation of the conveyor, they are often included in the group benefiting from the conveyor incentive. In each set of circumstances it is necessary to balance the desirable effects of group teamwork and group discipline against the undesirable effects of subordinating the individual to the speed of others, the greater difficulty met by an operator in calculating his earnings, and the possibility of a poor operator being protected by the group.

It has been suggested, although the author does not know of it ever having been tried, that an incentive in semi- or full-automatic plating could be based on an integrating ampere-hour meter measuring the actual current consumption of the material plated as compared with the possible current consumption with all carrier hooks being filled. This system would work only if the tank rheostat and the generator-field adjustment were not under the control of the operator.

Incentive systems have been badly abused in many instances, whatever their merits. Management must assume its share of the blame in the cases of failure. In many other cases of partial failure the cause was improper preparation before the system was launched. It is the author's firm belief that considerable time, effort and study are necessary before a completely successful system can be started. Executives are prone to become impatient for results and to launch an ill-prepared system staffed with incompetent or unskilled observers.

The steps necessary to be taken and policy formulation required are outlined in the following paragraphs.

Because most incentives and more particularly individual piece-rate incentives are based on straight-time hourly rates, it is necessary that all jobs have been fairly evaluated for skill, working conditions, responsibility, hazards, effort, etc., in relation to all other jobs in the plant. This is desirable and has been found increasingly necessary even if no incentive system is contemplated. Job evaluation is a field all its own and will not be discussed further here.

A very important, in fact essential, step of preparation before piece rates are set is the determination of the correct method of doing the work. This involves application of the principles of motion study and motion economy. Motion study and micro-motion study are highly developed techniques to determine the one correct method of arranging the work place, tooling, racking, proper jigs and fixtures, efficient utilization of both hands, etc., and thereby increase operator output and at the same time reduce operator fatigue. Frequently, micro-motion study technique which employs a special motion picture camera can be justified on highly repetitive operations.

Rates should always be established by a competent, experienced observer using a stop-watch technique or some other equally effective method. It has been the author's experience that many foremen are not good rate setters. In fact, rate setting is quite foreign to the many other abilities desired in a good foreman. The management of a plant should no more allow foremen to set rates than they allow a plating room foreman to run a foundry or vice versa. Highly repetitive operations, especially where machine speed largely sets the speed of the operation, are comparatively easy to study, whereas operations where the work is largely technique, such as polishing and buffing, are more difficult. On some operations requiring a great deal of technique it is frequently necessary for the observer to depend considerably on the honesty of an operator. In most cases, however, an experienced observer aided by the foreman can determine normal performance and can level the time properly.

A definite rate setting policy should be laid down, and it should be clearly understood by the operators and foreman. Such factors as personal allowance, fatigue time, necessary waiting time, set-up time and down time should be clearly defined, and firm policies established concerning them. If the study is being leveled to 100 per cent time, which is the minimum time in which the job can be done at top speed, the above mentioned allowances must be added plus the time representing the percentage over the hourly rate that the particular plant is willing for the operator to make for incentive effort. Sometimes when the study is leveled to normal performance, which is the speed expected of an hourly worker not on incentive, the allowances are made and the rate set without tak-

ing the incentive effort into account. The percentage for incentive effort over the hourly rate varies from plant to plant from 10 per cent to 50 per cent. The average is probably in the range of 15 to 20 per cent. It is emphasized that these things must be decided upon and clearly understood before a successful incentive system can be operated. There must be the closest cooperation between the department foreman and the observer at all times, and the help, advice, and assistance of the operator should be solicited and utilized wherever possible.

Temporary Rates

Frequently, it is necessary or desirable to set temporary rates because of temporary conditions, such as unskilled operators, improper tooling, small runs, change in methods, or substituted material. A policy should be clearly established as to how long a temporary rate is to exist, and the conditions under which it was set should be defined. These rates must be carefully watched, and permanent rates established as soon as possible. There have been many instances of temporary rates being used year after year, long after conditions causing them have been corrected, with the result that operators come to regard them as permanent; they then can be corrected only with difficulty. Temporary rates can be used successfully if clear policies have been established concerning their use and are understood by all parties involved and if a close follow-up eliminates them as soon as possible.

Top Operator Earnings

Policies must be formulated as to top operator earnings. If the policies are such that once a permanent rate has been set an operator can earn as much as possible with the blessing of the management and if proper rates have been set by competent observers reducing to a minimum the number of loose rates which could result in fantastic earnings and upset entirely the wage structure within the plant, a most harmonious condition can result at high productive levels. However, if management becomes envious of operator earnings and violates a policy against rate cutting only once, then employees lose confidence in the system and establish production ceilings beyond which they will not go. There have been many cases where such a condition has rendered an incentive plan virtually useless. Employee confidence is built up slowly and destroyed rapidly.

Rate Changes

A firm policy must be established under what conditions a rate may be changed. The most important of the provisions are:

1. No permanent rate will be changed unless there is a bonified change in method resulting in a definite change in operator time required. (Here it is necessary to have a clear record of all conditions at the time of rate setting or arguments will inevitably result.)

2. Rates are subject to fair adjustment where it is found that a mathematical error has been made in computing the rate.

3. Rates may be adjusted where it can be definitely established that an operator deliberately stalled or otherwise used excessive time during a study.

4. In cases of economic necessity where rate cutting is imperative to preserve profitable operation such as in periods of depression or falling prices, all rates shall be reduced horizontally.

Frequently, reccommendations as to job improvement, better tooling, more efficient handling of stock, and other worthwhile suggestions come from operators on the job. This is particularly true if encouraged and recognized. In piece-rate shops such suggestions may be rare unless properly handled. Frequently, an operator will hesitate to make a labor-saving suggestion because of fear that his rates will be restudied and he will be required to produce more in order to maintain his earnings. If, however, a properly formulated suggestion system is in effect which compensates him substantially for his proposal in the form of cash awards for the idea or in the form of a percentage of the savings for a definite period of time, such as six months or a year, this fear is minimized or overcome completely. Recognition in the form of editorials in the company paper and notices on bulletin boards are valuable supplements to the money awards, but in no way do they serve as substitutes.

The Successful System

In conclusion it is emphasized that incentive systems can be as successful in plating as in any production effort. Incentive systems properly formulated and administered will net 30 to 50 per cent more production and will make possible much higher take-home pay on the part of the operators. The plan must provide a true incentive and be superimposed upon a proper wage structure, preferably arrived at by job evaluation. Effective methods must be established by motion study techniques where necessary, before incentive rates are set. Firm policies and definitions dealing with temporary rates, permanent rates, rate cutting, restudy, top permissible earnings, and operator suggestions or improvements must be laid down and clearly understood by all concerned. Poorly formulated and administered incentive plans can result in nothing but industrial grief, whereas properly operated systems can and do result in higher production levels, more nearly complete utilization of machines, a reduction in overhead, lower costs, higher profits, and higher operator earnings.

ABNER BRENNER and EUGENIA KELLOGG

National Bureau of Standards, Washington, D. C.

Introduction

In the plating industry composite coatings of copper and nickel are extensively used, although they do not generally yield as good a protective value as an equal thickness of pure nickel. These composite coatings on steel consist of two layers: the first, copper, which is electrodeposited directly on the steel, and the second, nickel, deposited on the copper. The copper is less expensive than nickel and may be readily buffed as an undercoat for bright nickel. The present trend is toward the use of heavier composite coatings to secure increased protective value. The automotive industry commonly uses copper-nickel deposits up to 0.002 inch thick on steel parts. It is hence desirable to obtain a non-destructive method of measuring the total thickness and the relative thicknesses of the copper and nickel layers such as is described in this paper.

An instrument known as the "Magne-gage" has been used to measure the thickness of non-magnetic coatings and of nickel coatings on steel.* This instrument measures the attractive force between a small permanent magnet and the plated sample. This attractive force is dependent upon the thickness of the coating and the magnetic properties of the coating and base material. When a coating is interposed between the magnet and the magnetic base material, the attractive force is decreased provided that the coating is less magnetic than the base material, the decrease being greater the thicker the coating.

The Magne-gage is a spring balance, from one arm of which the magnet is suspended. A helical spring is attached in such a manner that as a knob is turned, the spring is wound up. The force required to detach the magnet is a measure of the attraction between the magnet and the specimen. The attractive force of the magnet for the sample is read from a dial attached to the turning knob. The thickness of the coating is determined from this reading with the aid of a calibration curve made with coatings of known values of thickness.

*Abner Brenner, J. Research NBS 20,357 (1938); RP 1081.

The Method

To determine the thickness of composite coatings, two magnets of different strengths are used. In order to compensate for the difference in the attractive force of the two magnets it would be necessary to use two different gages unless different springs were used or two magnets were hung at different distances from the pivot on the balance arm. For the measurements here reported, the stronger magnet was hung nearer to the pivot. A picture of the modified gage is shown in Fig. 1.

Nickel is somewhat magnetic, although not as much as steel, hence the calibration curve for the nickel coatings differs from that for copper coatings, since copper is practically non-magnetic. As can be seen from Fig. 2, the calibration curve for pure nickel coatings of given values of thickness fails considerably to the left of the curve for pure copper and is steeper.

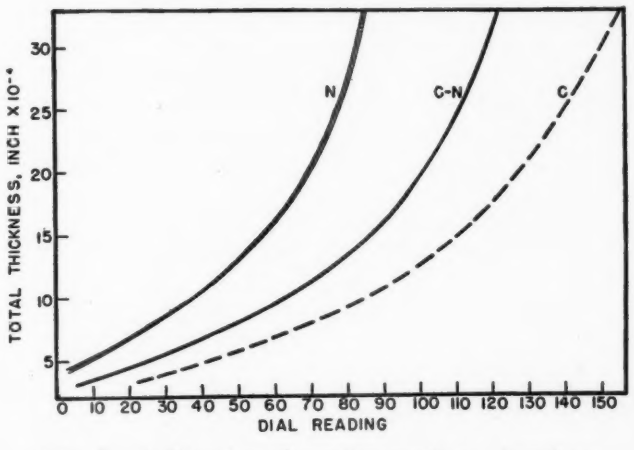


Fig. 2. Calibration curves for coatings of various percentages of copper and nickel on steel. N = 100% nickel, C–N = 50% nickel–50% copper, C = 100% copper

The calibration curve for any composite coating must fall within the boundaries of these two curves as, for example, does the curve for equal thickness of copper and nickel. In the absence of knowledge of the relative thickness of copper and nickel the total thickness

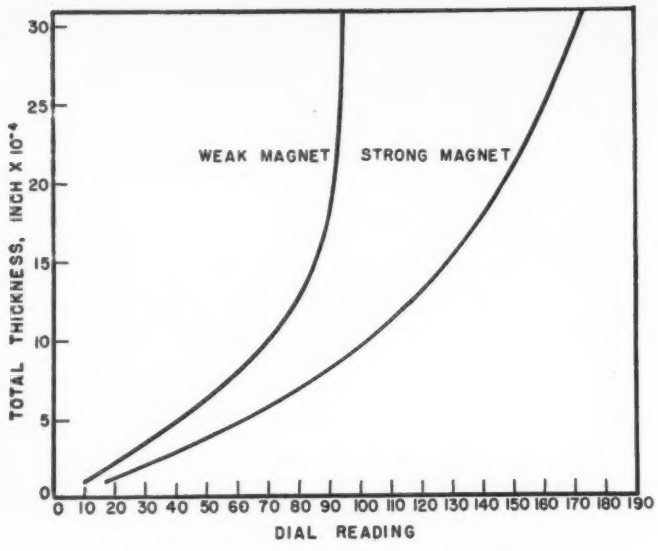


Fig. 3. Calibration curves for two magnets of different strengths with copper coatings on steel

cannot be determined from a single reading, since it can represent a number of thicknesses. For instance, in Fig. 2, a dial reading of 70 would represent a total thickness of 0.00049 inch of pure copper; 0.00085 inch of a half copper and half nickel coating; or 0.00168 inch of a pure nickel coating.

It is possible, by making measurements on a coating with two magnets of different strengths, to determine not only the total thickness but also the relative thickness of the two layers. This method is based on the fact that the calibration curves of magnets of different strengths have quite different curvatures. This is illustrated in Fig. 3 where the stronger magnet has about three times the magnetic strength of the weaker magnet. Curves for composite coatings of different compositions, such as 100 per cent copper, half copper–half nickel, and 100 per cent nickel were

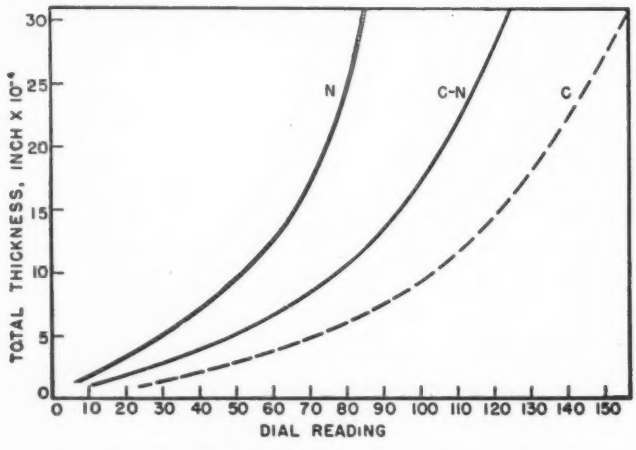


Fig. 4. Calibration curves of coatings containing various percentages of copper and nickel on steel for the strong magnet. N = 100% nickel, C–N = 50% nickel–50% copper, C = 100% copper

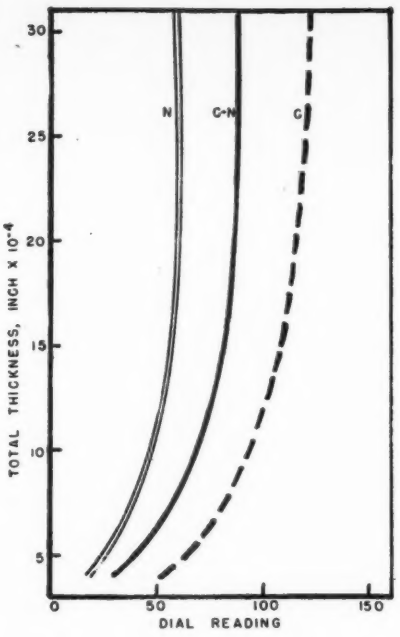


Fig. 5. Calibration curves of coatings containing various percentages of copper and nickel on steel for the weak magnet. N = *100% nickel,* C–N = *50% nickel–50% copper,* C = *100% copper*

prepared, as shown in Figs. 4 and 5. Suppose that on a given sample a dial reading of 78 was obtained with the weaker magnet and a reading of 80 was obtained with the stronger magnet. Assuming that the sample has percentages of copper and nickel represented by one of the calibration curves, there are six possibilities as to the thickness as follows:

	Thickness, inch x 10^{-4}	
	Magnet 1	Magnet 2
If 100 per cent copper.....	7.2	9.0
If 50 per cent copper–50 per cent nickel.....	13.4	13.4
If 100 per cent nickel greater than.....	30.0	26.2

The thickness must be the same when measured by each magnet and in this case is 0.00134 inch. The percentage of copper or nickel is defined by the point where the thickness readings for the two magnets coincide. Therefore in the above case half the total thickness must be copper. If the relative percentage of copper does not correspond to a specified curve, it becomes necessary to interpolate between the curves.

To avoid cumbersome, lengthy tabulations the following graphical method has been developed. The method involves the superposition of the graphs for one magnet on those for the other so that the pertinent gage readings coincide. The points of intersection of the curves are noted. In Fig. 6, the reading of 78 with the weaker magnet is superposed on the

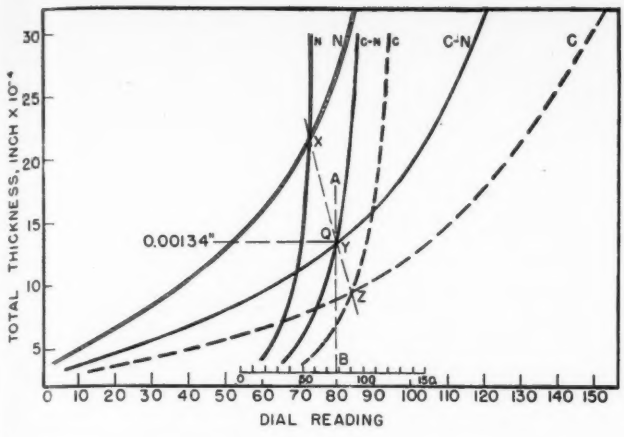


Fig. 6. Superposition of calibration curves of the weak (Fig. 5) and strong (Fig. 4) magnets. Intersection occurs on the 50% copper–nickel curves. Calibration curves for the strong magnet: N = 100% nickel, C–N = 50% copper–50% nickel, C = 100% copper; for the weak magnet: N = *100% nickel,* C–N = *50% copper–50% nickel,* C = *100% copper*

reading of 80 with the stronger magnet, at the line AB. Although the curves intersect at a number of points, those of like composition cross at only three points, X, Y, and Z. Through those points line XZ is drawn. The intersection Q of the line AB and the line XZ defines the total thickness, in this case 0.00134 inch, measured on the left scale. Since the thickness falls on the calibration curve for half copper and half nickel, it is not necessary to interpolate to determine the percentage of copper or nickel. If the interpolation is necessary, it may be done in the following manner. Suppose that a reading of 68 is obtained with

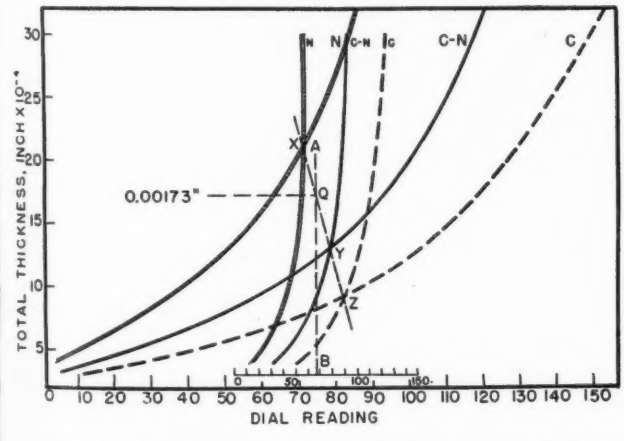


Fig. 7. Superposition of calibration curves of the weak and strong magnets. Intersection interpolated between curves. Calibration curves for the strong magnet: N = 100% nickel, C–N = 50% copper–50% nickel, C = 100% copper; for the weak magnet: N = *100% nickel,* C–N = *50% copper–50% nickel,* C = *100% copper*

the weak magnet and a reading of 75 with the strong magnet and that the curves are superposed as above. In Fig. 7, the two dial readings are represented by line AB. A line XZ is drawn through the points X, Y, and Z where curves of like percentage of copper intersect. The position of point Q, where AB cuts XZ, defines the thickness (0.00172 inch), which is read off from the ordinate, and also the percentage of the total thickness that is copper. Point Q lies somewhere between points X and Y, i. e., between the calibration curves for pure nickel and half copper and half nickel, hence the percentage of copper must fall between these two. Since Q lies along line XZ about 40 per cent of the distance from the half copper curve to the nickel curve, the copper content is

$$\frac{40}{100} \times 50 = 20 \text{ per cent copper.}$$

Although the variation in composition is not linear along line XZ, we may assume it to be linear without appreciably increasing the error in the determination of the percentage of copper of the coating.

Accuracy

The gage as designed will measure with a satisfactory accuracy composite coatings with total thicknesses of from 0.0005 inch to 0.0030 inch. Below and above this range the superimposed curves for the two magnets run virtually parallel. Within this range the error of the gage was found to be about 10 per cent for the total thickness and 15 per cent for the copper percentage determination, as shown in Table I. Measurements were made with the composite Magne-gage on especially prepared specimens and on commercially plated coatings to determine their thickness, and the thicknesses were checked by microscopic and chemical analysis. The chemical analyses were made by dissolving the coatings and analyzing the solutions by standard methods. Since the gage was calibrated with samples plated with standard "Watts" nickel, a study was made of the effects of bright nickel. It was found that the bright nickel deposits caused no error beyond the experimental errors of the gage itself. The accuracy of the gage may be seen in Fig. 8 and Table I, which include bright nickel coatings as well as "Watts" nickel. The per cent deviation in Table I is based on the total thickness obtained by chemical analysis. In most cases microscopic thickness measurements were made on areas adjacent to those used for the chemical analyses. Where the sample was found to be uniform, the microscopic determinations were concordant with the chemical results.

The sample must meet certain requirements to yield satisfactory measurements. An area at least one-inch square is required, especially for the stronger magnet.

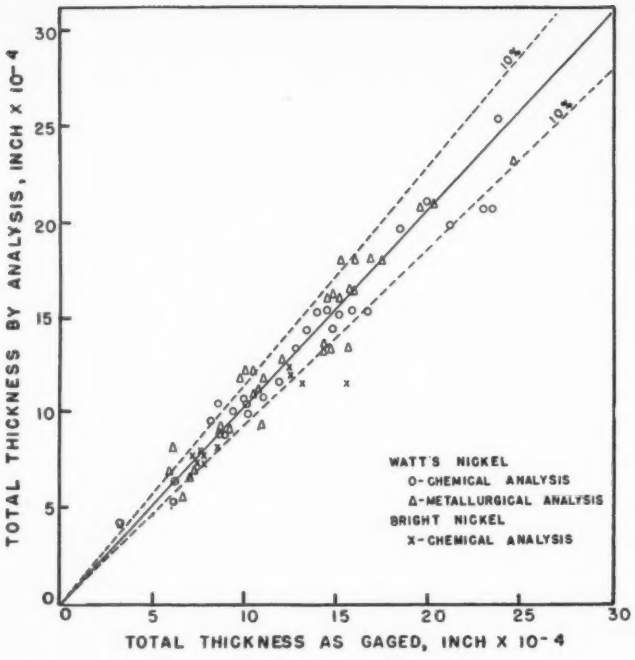


Fig. 8. Accuracy of the composite coating magnegage. The dotted lines represent a 10% deviation of thickness obtained by gaging from the thickness obtained by analysis

If this area is unobtainable, the sample should be placed on a larger steel backing. The specimen should have a radius of curvature of not less than half an inch. An error of one dial division will cause an appreciable error in thickness. For example, with the weaker magnet in the range from 0.0010 inch to 0.0020 inch, one dial division will cause an error of 0.00014 inch or about 8 per cent if the sample is pure nickel and with the stronger magnet an error of 0.00006 inch or about 5 per cent. Care, therefore, must be taken in making the readings and in providing an adequate area and a sufficient radius of curvature.

Standard Samples

For the initial calibration and subsequent checking of this gage standard thickness samples will be provided. For each composition of coating each set will consist of four specimens with different thicknesses of coating on steel. It is probable that all requirements can be met by three sets of specimens, consisting respectively of (a) pure nickel, (b) half copper and half nickel, and (c) pure copper.

TABLE I. ACCURACY OF COMPOSITE COATING GAGE

Specimen			Total Thickness			Thickness of Copper, % of Total		
No.	Plating by*	Type nickel†	Chemical Analysis inch x 10^5	Composite Gage Results inch x 10^5	Deviation per cent	Chemical Analysis	Composite Gage Results	Difference per cent Copper
1	Com	B	40	31	−23	63	100	+37
2	Com	B	61	52	−15	44	50	+ 6
3	Com	B	63	62	−22	21	30	+ 9
4	Com	B	66	109	+65	84	76	− 8
5	NBS	B	71	73	+33	0	10	+10
6	NBS	B	76	72	−66	35	45	+10
7	Com	B	77	72	− 7	38	54	+16
8	NBS	B	78	76	− 3	35	40	+ 5
9	Com	B	87	86	− 1	86	76	−10
10	Com	B	86	87	+ 1	38	30	− 8
11	Com	B	93	82	−12	24	30	+ 6
12	Com	W	97	93	− 4	57	60	+ 3
13	Com	W	102	86	−16	56	70	+14
14	NBS	W	105	100	− 4	76	75	− 1
15	NBS	B	113	132	+17	24	25	+ 1
16	Com	B	130	128	− 2	20	8	−12
17	Com	W	136	134	− 1	59	55	− 4
18	NBS	W	148	152	+ 3	75	80	+ 5
19	NBS	W	149	166	+11	75	60	−15
20	Com	W	150	145	− 3	59	55	− 4
21	NBS	W	191	185	− 3	25	25	0
22	NBS	W	199	205	+ 3	75	80	+ 5
23	NBS	W	201	235	+17	25	33	+ 6
24	NBS	W	247	222	−10	25	40	+15

*Com refers to commercially plated samples; NBS to those plated at Bureau of Standards.
†B refers to bright nickel; W to "Watts" nickel.

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Polishing a Kensington Ware tray to give it a high finish

POLISHING AND BUFFING ALUMINUM

C. J. HINTON, *Development Division, Aluminum Company of America*

This article emphasizes certain differences between polishing and buffing aluminum and other metals. Special attention is given to the buffing of soft aluminum surfaces

ALTHOUGH THE techniques used in polishing and buffing aluminum are quite similar to those employed for other metals, certain physical properties of aluminum call for some differences. Since aluminum and its alloys are usually softer than many of the commonly used metals, they require both lower wheel speeds and finer abrasives. Proper lubrication is also more important with aluminum because of its high coefficient of friction which generates enough heat during certain operations to emphasize this requirement.

Where hand finishing operations are necessary, the ability of the operator is naturally very important. Proper conditions and equipment will not produce quality and uniformity unless correctly and skillfully employed. This is particularly true for touch-up work and for finishing articles of irregular shapes.

A variety of finishes may be obtained on aluminum by mechanical means, but the sequence of operations is essentially the same regardless of the product involved. Therefore the adaptation of the following

general principles should be sufficient for practices on all types of alumium products.

The Polishing Operation

Uneven or deeply scratched surfaces, such as on sand castings and the like, should receive a preliminary coarse polishing or roughing operation. A smooth-faced wheel with 60 to 100 mesh emery usually will do, although in some instances a 60 to 120 mesh aluminum oxide grit is preferred. The wheel itself may be from 12 to 20 inches in diameter and operate at a peripheral speed of about 6,000 feet per minute. Tallow or similar lubricant reduces overheating.

Plain flat work lends itself to roughing by means of abrasive belts. These belts should be set up with 80, 120, 140, and 180 grit and may be lubricated with tallow and machine oil or with a thin paste of paraffin and turpentine. In some cases silicon carbide No. 80 or flexible paper wheels will accomplish the roughing operation without lubricants.

The secondary polishing operation, known as oiling, calls for finer abrasives and softer wheels than those used in roughing. It is customary to use felt wheels faced with 100 to 160 mesh abrasive and supply sufficient lubrication. Wheel speeds are normally the same as for roughing.

A Kensington Ware tray being oiled in a preliminary step to the high finish applied later by polishing

The Buffing Operation

Buffing, the next step in the normal sequence, produces a lustrous finish. Loose or stitched muslin wheels with paper or wood separators may be used as the character of the work indicates. Unlike polishing, the buffing abrasive is applied to the revolving cutting face of the wheel from a stick held against the surface. Tripoli, silica, or a mixture of tripoli and silica, held together with a grease binder or a water soluble material, are the most common cutting materials. The size and shape of the work being done determines the diameter and face of the buffing wheels. Operating wheel speeds should normally range between 7,000 and 7,500 feet per minute.

Coloring, the final operation in normal finishing procedure, imparts a characteristic silver-white color and high luster to the surface of aluminum. Open muslin or canton flannel wheels are usually employed, with speeds ranging from 7,500 to 8,000 feet per minute. Vienna lime, or white silica in brick or cake form, is the abrasive used in coloring. No metal is removed by this operation.

To establish hard and fast rules governing buffing sequences would be of little value inasmuch as the desired finish, the condition of the surface, the skill of the operator, and the shape of the part all influence the operation. Sand castings are usually finished with a 4-wheel sequence, i. e., roughing, greasing, buffing, and coloring. Die castings, on the other hand, may

Buffing an aluminum cafeteria tray

require a 2-, 3-, or 4-wheel sequence, depending upon the desired finish and the initial condition of the surface. Sometimes screw machine products are given a buffing and coloring treatment, although more frequently they are finished by tumbling or left unfinished.

Wrought products, prinicpally sheet, are usually buffed and colored. Forgings, tubing, and extrusions are also finished in this manner if surface conditions permit. An oiling operation to remove die lines and other surface markings is usually desirable prior to buffing when materials of this nature are to be finished.

One difficulty encountered in buffing aluminum is that particles of aluminum "build up" on the polishing wheel and may cause gouging of the surface. Proper lubrication will usually correct this situation. The embodying of abrasive particles into the metal surfaces can also be troublesome, particularly when the article is to be electroplated or given the Alzak* electropolishing or Alumilite* anodizing treatment. An acid or alkaline pickling operation between the buffing and coloring processes is helpful in removing such imbedded particles.

Buffing Reflector Surfaces

Although the buffing procedure for Alzak reflector surfaces contains no unusual operations, special care must be exercised to prevent imbedding of the buffing compound into the surface. Excessive "dragging" of the reflector surface may result in pitting during the Alzak reflector processing treatment. The buff used should be so constructed that "dragging" and gouging of this high purity alloy can be avoided. For hand work the soft buff is best and the spindle speed should be 2,800 rpm. A satisfactory buff, 8 to 10 inches in diameter, may be built up of 12 to 15 discs sewed together spirally near the arbor hole. The cloth used may vary in thread count from 64–68 to 84–92, with the higher thread count giving a hard buff. Buff hardness may be regulated by means of 3-inch cloth disc separators between the large discs that make up the base of the buffing wheel. The larger the number of cloth separators per unit width, the softer is the buff. Buff hardness increases with the speed of the wheel, and for this reason the latter is an important consideration.

The most common agent used for buffing aluminum reflector sheet is tripoli compound. If some particles of this material should become imbedded in the surface of the high purity aluminum cladding, they can be removed prior to the color buffing operation by treating the reflector sheet in a weak caustic soda solution at approximately 120° to 140° F for a period of 30 to 60 seconds. A chromic acid-sulfuric acid pickle may also be used for this purpose. Following this cleaning operation the sheet is color buffed with a suitable coloring compound.

Buffing a three-compartment aluminum tray

In order not to cut through the high purity surface of the Alclad sheet used for specular Alzak reflectors and thus expose the underlying base metal, care must be taken during the buffing and coloring operation. If the Alclad coating is cut, dark spots of low reflectivity will appear on the reflector surface wherever the base metal has been exposed. When this happens, the reflector must be scrapped.

It is also important to avoid local overheating of the surface resulting from high buff pressure. This may cause dull areas which are not easily removed during the color-buffing operation and may affect the efficiency of the reflector. Such a condition can be prevented by using a buff of proper softness or by employing a tripoli compound which cuts faster and requires less buff pressure.

Applications

Alcoa research and development has made it possible to apply to aluminum all the mechanical finishes commonly used in the industry. Most of these finishes are designed for improved appearance to enhance the retail value of the product and add little or nothing to the corrosion resistance of the surface. However, mechanical finishes are also highly important as a surface preparation for subsequent chemical, electrochemical, and organic coatings.

*Aluminum Company of America patented processes.

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ELECTROPLATING FROM FLUOBORATE SOLUTIONS

I. COPPER

KARL S. WILLSON, A. H. DuROSE and D. G. ELLIS

Research and Technical Service Laboratories
The Harshaw Chemical Company, Cleveland, Ohio

THE GROWING NEEDS for high speed plating baths have led to increasing interest in fluoborate solutions.

Complex compounds resulting from various combinations of boric and fluoboric acids have long been of academic interest, but even today much of the chemistry of the fluoborates is unexplained. However, unlike the copper cyanide bath in which the monovalent copper is tied up in the cyanide complex, a fluoborate solution contains the copper as a simple divalent ion, much the same as in copper sulfate. In fact, copper fluoborate and other fluoborates are similar to the sulfates in many ways, with the greater solubility of the fluoborates being responsible for at least a part of the differences of interest to the plating industry.

While the use of fluoborates in plating baths was patented in Germany in 1886[1], it is only relatively recently that commercial installations of fluoborate plating baths have been seriously considered. Previous publications[2,3] have disclosed many of the properties of fluoborates such as copper, tin, lead, and zinc which are of interest to the commercial plater. The results here reported for copper fluoborate tend to confirm previously published data, with some modifications, and extend the knowledge concerning this newer type of bath.

Because of the somewhat greater cost of the copper fluoborate, a brief study was undertaken to determine whether the advantage of high speeds could be secured in mixed sulfate-fluoborate baths and whether such mixed baths would permit use of tanks and other equipment having lead linings.

[1]Leuchs, G., German Patent 38,193, May 3, 1886.
[2]Narcus, H., Metal Finishing 43, 188–190, 199, 242–244 (1945).
[3]Struyk, C., and Carlson, A. E., Monthly Rev. Am. Electroplaters' Soc. 33, 923–934 (1946).

Experimental Conditions

For still plating baths, copper sheet was used as both anode and cathode, with spacing as close as approximately ¼ inch in some instances where high current densities were tested. Various types of agitation served to increase the limiting current density, but in the laboratory tests most consistent results were secured with a rotating cathode within a circular copper wall, again with a spacing of the order of ¼

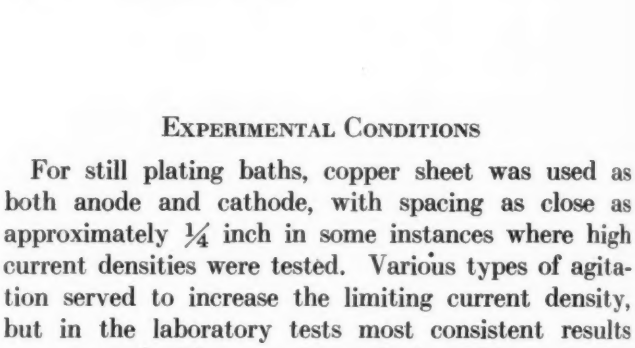

Fig. 1. Effect of copper concentration and bath temperature on limiting current density in copper fluoborate baths. Curve 1 at 80° F, curve 2 at 100° F, curve 3 at 120° F, curve 4 at 140° F

inch. Because of the short distances and difficulty in maintaining exact currents, slight irregularities were encountered. However, with few exceptions the obtained values fall on smooth curves and are believed to be accurate to within 25 asf.

Voltages and Limiting Current Densities

Results of the tests are shown in Figs. 1, 2 and 3 and in Table I.

On diluting the fluoborate concentrate, a *p*H of about 1.4 was secured and this *p*H was used in most of the fluoborate tests. Added free fluoboric acid lowered the solution resistance slightly and also caused a small decrease in limiting current density without any apparent improvement in the deposit. With *p*H values considerably above 1.4, a blue-black deposit was had in the low current density areas. Copper carbonate or fluoboric acid was used to adjust the *p*H when necessary.

Since boric acid has little influence on the limiting current density and is desirable to prevent hydrolysis of fluoborates, all solutions were essentially saturated with it.

Voltage requirements to be expected in plating from a copper fluoborate bath will depend on the spacing of anodes, work, etc.; it was believed that comparative tests on sulfate and fluoborate solutions in the same test unit would be preferable to absolute measurements and could be projected within reasonable limits to larger equipment for which operational data on sulfate solutions are available.

Because of the small scale equipment and the difficulties encountered in maintaining constant temperature, current, etc., highly precise values could not be obtained; however, the voltages were consistent in practically all instances and general trends have been established.

All voltage tests were run at 110° to 120° F, at which temperatures agitation was found to have little effect on the voltage.

The initial voltage at the start of a plating test in fluoborate solutions was found to be usually about 0.2 volts higher than the steady operating voltage. In tests which resulted in burning of the test plate, the final voltage was lower than normal, as much as 0.5 volt below the initial voltage.

The drop from initial to operating voltage was quite rapid; although the same general results were secured for both sulfate and fluoborate solutions, the sulfate solution tended to show somewhat greater differences between initial and operating voltages, particularly at the higher current densities.

With the apparatus used, the average values for the operating voltages under the various conditions were as shown in Table I.

It is evident that voltage requirements for fluoborate solutions will lie between those for sulfate solutions

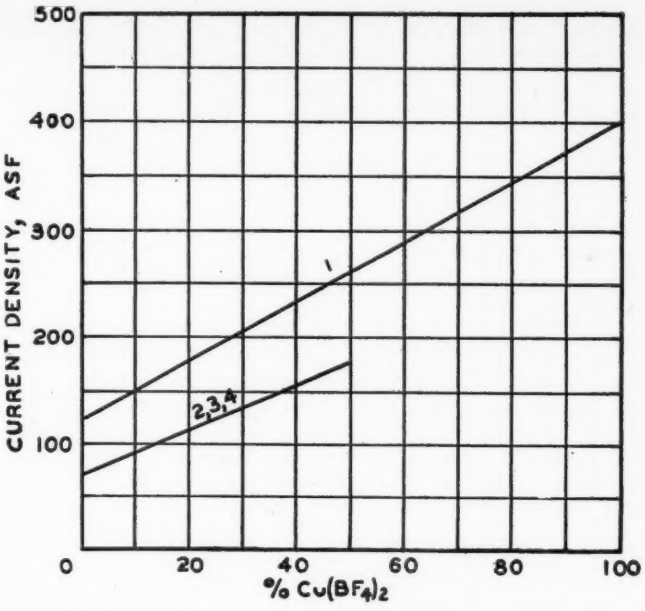

Fig. 2. Effect of copper fluoborate/copper sulfate ratio at 110° F in mixed bath containing 75 g/l copper. Curve 1 with 4, curve 2 with 30, curve 4 with 60, curve 4 with 90 g/l sulfuric acid

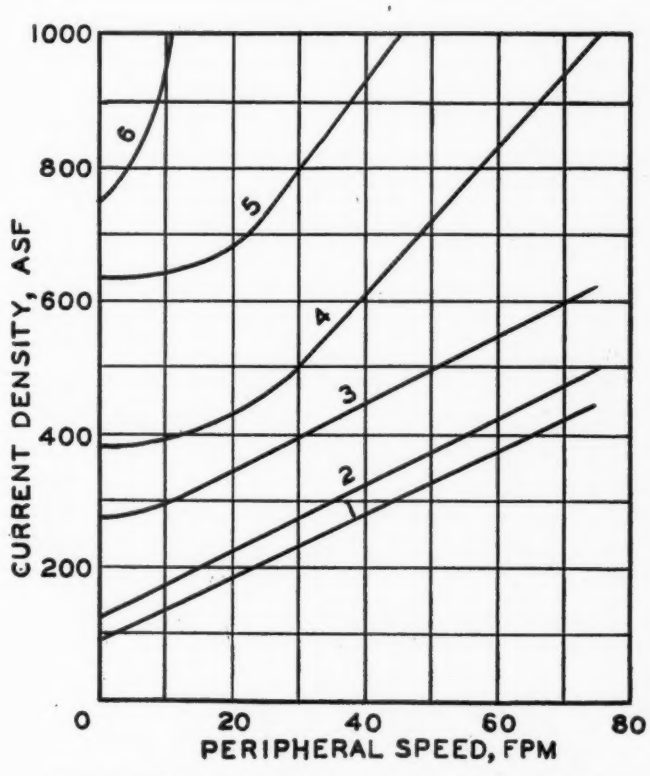

Fig. 3. Effect of agitation with rotating cathode on limiting current density at 110° to 120° F. Curve 1 with 75 g/l copper as copper sulfate, 90 g/l sulfuric acid; curve 2 with 75 g/l copper as copper sulfate, 4 g/l sulfuric acid; curve 3 with 75 g/l copper derived from equal weights of copper sulfate and copper fluoborate; curve 4 with 75 g/l copper as copper fluoborate; curve 5 with 120 g/l copper as copper fluoborate; curve 6 with 180 g/l copper as copper fluoborate

TABLE I. CELL VOLTAGES

	Cathode current density, asf								
	100	200	300	400	500	600	700	800	900
Sulfate Solution, g/l									
75 Cu, 4 H_2SO_4	2.0	2.6	3.1	3.6	...	...	...	...	...
75 Cu, 90 H_2SO_4	1.0	1.5	1.9	2.4	...	...	...	...	...
Fluoborate Solution, g/l									
75 Cu, 0 HBF_4	1.5	2.1	2.6	3.2	3.8	4.3	4.9	...	...
75 Cu, 64 HBF_4 (45%)	...	1.8	2.3	2.9	...	...	...	...	...
120 Cu, 0 HBF_4	...	1.8	2.3	2.8	3.3	3.7	4.3	4.7	5.2
120 Cu, 64 HBF_4	...	1.8	2.3	2.7	3.1	3.6	4.1	4.4	4.9

without added free acid and with added acid. The effect of free fluoboric acid is relatively small; since its use lowers the limiting current density somewhat, larger amounts do not appear warranted.

Use of the higher copper content (i. e., 120 g/l) which is possible with the fluoborate will result in a somewhat lower voltage requirement at the high current densities. As in the sulfate bath, the copper fluoborate ionizes to give a copper ion without the complex formation which occurs in the cyanide bath. As a consequence, the throwing powers of the fluoborate and sulfate baths are similar.

The following conclusions may be drawn in respect to the limiting current density.

1. The limiting current densities are higher in copper fluoborate than in copper sulfate baths.
2. Increasing temperature or copper content increases the limiting current density. (Because copper fluoborate is much more soluble than copper sulfate, higher copper concentrations are possible.)
3. Mixtures of sulfate and fluoborate have limiting current densities which fall between those of either constituent and in a direct proportion to the concentration of each.
4. Free sulfuric acid in either a sulfate or mixed bath lowers the limiting current density and also the voltage.
5. Increasing agitation increases the limiting current density very markedly.

Lead Corrosion by Fluoborates

Because fluoborate or mixed fluoborate-sulfate solutions might be considered for use in existing lead tanks, tests were undertaken to determine the corrosive effect. Both chemical lead and 6 per cent antimony lead were tested with comparable results.

Mixtures containing over 25 per cent of the copper as fluoborate (75 g/l total copper) produced rapid attack on the lead at 140° F. With less than 15 to 25 per cent fluoborate, no apparent attack on the lead occurred below the solution level, but some corrosion was noted above it within the 10 to 25 per cent fluoborate range. A white powdery material, undoubtedly lead sulfate, tended to form and would give difficulties in plant operation. For these reasons, lead is not recommended even for low-fluoborate mixtures.

A few tests were also made to determine the effect of lead as an auxiliary anode (as in an anode basket). While currents of the order of only a few milliamperes passed through the lead anode in a sulfate bath, mixed baths gave many times greater current; in both cases the amperages were erratic, varying with time, previous tests and apparently other factors. Because of the corrosion test results, little further was done on the anode effect.

Effect of Sodium and Potassium

Because of possible drag-in, sodium and potassium ion effects in the bath are of interest. Results of previous workers[3] were verified; sodium ion in small quantities did not markedly affect the operation while with larger amounts, more than ⅔ g/l, some brightening occurred but the limiting current density was decreased. The resistance of the solution also decreased.

Similar results were secured with potassium, although the effects appeared to be somewhat less; precipitation occurred more readily, thus providing a possible means for avoiding alkali metal build-up due to carry-over from the strike solution.

Effect of Iron and Manganese

Slight lowering of the limiting current density occurred in sulfate and fluoborate baths only when the concentration of iron or manganese reached 3-5 g/l.

Bath Control

Copper can be determined by the usual iodometric method. Narrow-range colorimetric papers have been found reasonably satisfactory for determination of *p*H as low as about 1.0 and, for control purposes, will give approximate values at somewhat lower levels.

(*Continued on page 304*)

Notes on Laboratory Control of Plating Solutions

By R. B. SALTONSTALL

The Udylite Corporation, Detroit, Michigan

THREE GENERAL TYPES of plating solution control have been and are being used, namely:

1. Careful observation of production results and corresponding additions or changes based on experience.
2. Control by chemical analysis
   (a) Determination of materials added intentionally (metal ions, anions, hydrogen ion, addition agents, etc.).
   (b) Determination of known impurities unavoidably or accidentally present but not added intentionally (metal ions, chromic acid, etc.), usually present in small concentrations.
3. Control by pilot plating tests through determination of physical characteristics of the deposit such as brightness, smoothness, adhesion, and ductility.
   (a) Check on results from (1) and (2).
   (b) Check on addition agents which cannot be determined chemically.
   (c) Check on impurities which can or cannot be determined chemically.
   (d) Testing effects of corrective measures and additions.

To one familiar with production plating operations, it is readily apparent that there is some overlapping between these three classifications of control measures.

In the first place, there is no completely satisfactory substitute for experience and the good judgment that is usually acquired with it. However, few modern plants of any size depend entirely on the experience of their operators; in fact, chemical control is essential if solutions are to be maintained in proper balance during production runs. There are so many variables not easily controlled that it is poor practice not to control those which lend themselves to simple, rapid and sufficiently accurate chemical methods.

Pilot plating tests, whether carried out in a 400 cc beaker, a Hull cell, a one-gallon battery jar, or a crock of larger capacity, are most valuable in supplementing the other two methods of control, and with proper experience in interpretation may be substituted for chemical control in emergencies. Such tests require that production conditions such as temperature, current density, agitation, etc., be duplicated as nearly as possible. If test facilities have been kept in readiness, trouble can frequently be diagnosed or even anticipated and corrective measures tested in far less time than is required for a complete chemical analysis of the solution. Such tests may also indicate very quickly that the difficulty being experienced is not being caused by a condition of the plating solution itself but by other variables in the process cycle or by mechanical or electrical factors.

Pilot tests are best made in the plant or laboratory of the plant in which the solution is operating, because the results can be compared quickly with those obtained in production. When facilities are not available close at hand, much valuable time is lost in transporting a sample of the plating solution to a distant laboratory. Even then, however, producton time may be saved when pilot tests are run immediately on receipt of the sample. Results and recommendations can be communicated to the plant very quickly.

A few suggestions to those who depend on laboratories outside the plant for pilot plating tests may be helpful. It is of great importance that someone in the laboratory doing the work should be made as familiar as possible with the problem. When practicable, samples of work showing the defect should accompany the solution sample. This will tell the chemist what to look for. Be sure to send a sample of solution at least as large as requested by the laboratory and if the problem appears to be a difficult one, send more. Pack the sample carefully against breakage and use a container which is known to be clean and will not be attacked by the solution. We still receive occasional samples of both acid and cyanide plating solutions in tin cans, which, of course, contaminate the solutions during transit to such an extent that the original defects are completely hidden; much valuable time is lost because new samples in suitable containers must then be sent.

It should be remembered that the laboratory cannot start working on a sample before it arrives; hence the choice of carrier should be governed by the urgency of the case. Most plating solutions are considered corrosive or poisonous by postal authorities and must *not* be sent through the mail.

By all means, treat your consultant or supplier as you would your physician: tell him the whole story; if you have made an error which might possibly have a bearing on the trouble, don't withhold that information from him. The more complete his knowledge of the situation, the faster he can help you to get out of trouble.

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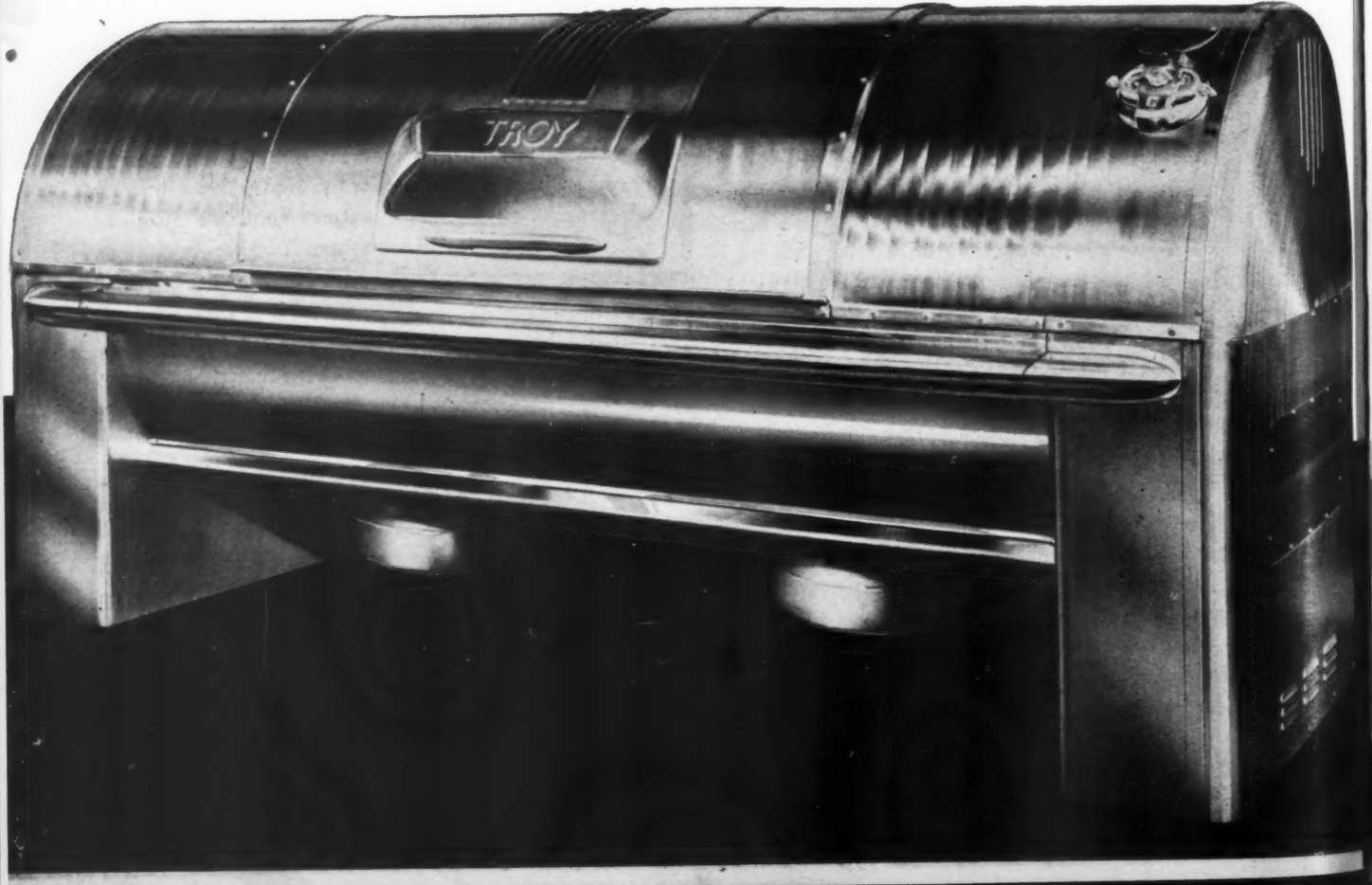

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project director:
EARL J. SERFASS

associates:
W. S. LEVINE
J. E. OYLER

location:
LEHIGH UNIVERSITY,
BETHLEHEM, PA.

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Determination of Impurities in Electroplating Solutions

VIII. TRACES OF SODIUM AND POTASSIUM IN NICKEL PLATING BATHS

Introduction

Although sodium and potassium ions are universally present in nickel plating baths, investigation showed that an analytical method for the determination of these ions was desirable. Consequently, a colorimetric method has been developed for sodium making use of magnesium uranyl acetate, which only awaits evaluation in cooperating laboratories. Since the demand for a determination of potassium is not as great as for many other ions and the development of "wet" chemical methods is time-consuming, it was decided that a rapid, straightforward method involving special equipment would best serve the purpose in this instance. Fortunately, an instrument for both sodium and potassium as well as other elements has been developed in recent years. This instrument, the flame photometer, appeared to be the answer to the problem of providing methods for the determination of sodium and potassium.

The purpose of this investigation, therefore, was to use the flame photometer for the rapid and accurate determination of traces of sodium and potassium in nickel plating baths when appreciable quantities of aluminum, cadmium, copper, chromium, lead, manganese, iron, silica, zinc and calcium are present as impurities in the bath.

Low temperature emission spectroscopy, which has been named flame photometry, was developed by Barnes, Richardson, Berry and Hood[1] as a result of an urgent need for extremely rapid and accurate determinations of sodium in a large number of samples. Flame photometry was the only physical method which would fulfill the requirements of speed and accuracy, minimum of sample handling and preparation, and use of inexpensive and simple equipment.

The characteristic radiations emitted by metallic atoms when excited by high temperatures or by electrical means form the basis for emission spectroscopy. It was first developed as a method of quantitative analysis by Lundegardh in 1929[8]; the Lundegardh or "air-acetylene flame" method is capable of analyzing thirty-four different metallic elements[3] and has so been used for many, including sodium and potassium[3,4,8,9]. In this method, the sample to be analyzed is put into aqueous solution and sprayed under controlled conditions into the acetylene flame. The air and acetylene are carefully regulated to maintain constant burning conditions. The light from the Lundegardh flame enters the slit of a spectrograph, spectrograms are prepared, and the intensities of the spectral lines are measured with a microphotometer. Using solutions of known composition and concentration, calibration curves are prepared from which unknown concentrations may be determined. It has been shown that errors due to variations in air and acetylene pressures, in quantity of mist introduced into the flame, and in viscosity may be largely eliminated by use of an internal standard[3]. The internal standard is merely a known quantity of one element added to every solution to be analyzed. The intensity of the lines of the standard rather than the background is used as a basis for measuring the intensities of the unknown elements.

A modification of this method makes use of a monochromator to isolate the desired wavelength and a photocell and

electrometer to measure the intensity of the lines. This method was first used to determine the alkali and alkaline earth metals[7] and later other metals[5]. The successful determination of potassium with suitable filters instead of amonochromator to isolate the red line of potassium has been reported[10].

The air-acetylene flame method, although accurate, was undesirable for the analysis of sodium and potassium because of the considerable amount of manipulation and equipment required. Because the high temperature of the acetylene flame causes emission of characteristic radiation from many elements, difficulty results in isolation of the lines of sodium and potassium. However, when a solution is sprayed into the flame of a burner which uses ordinary illuminating gas as fuel, only a few elements besides the alkali and alkaline earth metals will emit characteristic radiation. This reduction in the number of elements which will be excited makes possible the use of suitable filters to isolate the radiations of sodium and potassium. These characteristic radiations, upon striking a photoelectric cell, give rise to an electrical impulse which is a function of the amount of metal present in the sample[1]. This is true only when conditions of the flame and the rate of atomization are kept constant. The flame photometer developed by Barnes and coworkers is an instrument which fulfills the above requirements for the analysis of sodium and potassium in the presence of many other metallic elements.

The instrument used for this investigation was a Perkin-Elmer Flame Photometer which is essentially the same as the one described by Barnes[1,6]. It consists primarily of six parts—the air pressure regulator, the atomizer, the burner, the optical system, the photosensitive detector and the galvanometer. A beaker containing the sample to be analyzed is placed on the small shelf provided for it with the sample inlet tube reaching down into the solution. The solution is drawn up the inlet tube to the atomizing jet through which it is sucked by the blast of compressed air. The pressure of the air is indicated by the air pressure gauge and is adjusted by the air pressure control. The vaporized sample is drawn into the base of the burner and up into the flame where it is ignited. The light emitted from the flame passes through a window in the chimney housing of the burner, through a water cell which serves to absorb radiant heat from the burner, and thence through a lens which focuses the beam through the filter system and onto a photoelectric cell. The output of the photoelectric cell is balanced to a null position on the output meter by a variable voltage the value of which is used as a measure of the concentration of the constituent in the flame. The electrical controls consist of a switch to select the sodium or potassium phototubes, a zero adjustment for each element for setting the output meter to zero, a range control for each element and the ratio dial. The range control permits the instrument to be adjusted so that any desired concentration of sodium or potassium will read 100 (or full scale) on the ratio dial. The ratio dial, in arbitrary units from 0 to 100, indicates the value of the voltage required to balance the output of the photocell. With this arrangement the instrument can be calibrated to cover any desired range of concentrations, using a previously prepared calibration curve for each range.

Whereas this photometer measures absolute light intensities, an improved flame photometer has been developed which uses a dual optical system. This improved instrument utilizes the principle of the internal standard and measures light intensity ratios instead of absolute intensities, thereby reducing the disturbing effects of fluctuating air and gas pressures and varying rates of atomization[2].

Developmental Work

Constant gas pressure being a prerequisite for consistent results with the instrument, it was found that the pressure of the gas supply was fluctuating sufficiently to require the use of a constant pressure regulator as described in the instruction manual for use of the flame photometer[6]. The use of a head of 5 inches of water gave satisfactory results, and this pressure was used in the remainder of the tests. No trouble was experienced in maintaining the air pressure at the recommended value of 13 psi.

During trial runs with standard solutions of pure sodium chloride ranging from 0 to 100 ppm of sodium, three important points became evident: (1) a minimum time of 30 minutes is required before the "zero" and "range" settings cease to shift appreciably; (2) between each run of a sample, distilled water must be run through the atomizer to clean off remaining traces of the previous sample; (3) although the calibration of the range control is reported to be stable over a period of 5 to 6 hours, it is necessary to check these settings at least every half hour, and if they are changing, even more often. Only when these conditions were fulfilled were results satisfactory.

In trying to obtain data for the calibration curve, a series of synthetic "50-50" nickel plating bath solutions made from recrystallized nickel salts and containing from 0 to 100 parts per million of sodium and potassium were prepared first. Although every precaution was taken, erratic and non-reproducible results were obtained as the "zero" and range control persisted in shifting. These varying results were believed to be due to two factors: First, the high concentration of nickel salts in the bath (1.5 N $NiCl_2$ and 1.5 N $NiSO_4$) resulted in some

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2	22.5		2	19	
	20	21		21	20
	19.5			20.5	
4	40.5		4	39	
	41.5	41		38	39
	41			39	
5	51		5	50	
	49	50		49	50
	49.5			50	
6	61		6	58	
	59	60		57	57
	60.5			57.5	
8	81		8	78	
	81.5	81		78.5	78
	80			79	

a. e. s. research project no. 2

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	80			79	

of the nickel coming out of solution upon being atomized and depositing on the sides of the atomizer container. This layer of nickel salts probably absorbed some sodium from the solution and caused the erratic settings. Even prolonged washings with distilled water failed to clean the glass thoroughly and finally the atomizer was removed to be properly cleaned. Second, the deposition of nickel salts on the atomizer jet had the effect of varying the rate of vaporizing the sample. It was found that both of these effects could be eliminated by diluting the sample (1:9) with distilled water. Using this dilution factor in all subsequent runs, the nickel salts no longer deposited in the atomizer and the intermediate washings thoroughly removed any remaining droplets of the previous sample. Thus, fading in the zero and range settings dropped to a minimum when the bath had been diluted.

Preparation of Calibration Curve

A pure synthetic "50-50" nickel plating bath prepared with recrystallized nickel chloride and nickel sulfate, and a standard sodium chloride and potassium chloride solution were used to make a series of standards ranging from 0 to 100 ppm each of sodium and potassium. The required volume of the sodium and potassium standard was placed in a 25-ml volumetric flask and diluted to the mark with the nickel solution. A 10-ml portion of each standard solution was diluted to the mark with distilled water in a 100-ml volumetric flask, thus reducing the range of the standards from zero to 100 ppm to zero to 10 ppm. Triplicate runs were made on these diluted solutions at each concentration according to the "Recommended Routine Procedure" given below and the results averaged. Table I shows the data obtained from these runs.

By plotting the mean readings against the corresponding sodium and potassium concentrations the curves shown in Figs. 1 and 2 are obtained.

Recommended Routine Procedure

The procedure finally adopted for the routine analysis of sodium or potassium is the following:

Solutions Required

1. Standard sodium chloride and potassium chloride solution—1 mg Na/ml and 1 mg K/ml
   Dissolve 2.545 g of pure sodium chloride and 1.881 g of pure potassium chloride in 1 l distilled water.
2. Synthetic "50-50" nickel plating bath
   Dissolve 97 g recrystallized nickel chloride, 116 g recrystallized nickel sulfate and 30 g boric acid in distilled water to make 1 l solution; filter to remove any insoluble matter.

Apparatus Required

1. 100 ml beakers
2. Perkin-Elmer Flame Photometer
3. Air compressor—any supply of clean compressed air

Procedure

1. Fill the water cell with distilled water. Check the water level every hour or so; if allowed to run low, the phototubes will be damaged by radiant heat.
2. Turn the range and zero adjustor knobs to zero (counter-clockwise), and set ratio dial scale to zero.
3. Turn on the amplifier with the switch directly below ratio dial; the pilot light should show green.
4. Turn on the air to the instrument, and adjust the pressure to 13 psi.
5. Turn on the gas, and light the burner with a match or preferably with a Bunsen burner.
6. Allow the instrument to warm up for at least 30 minutes.
7. Turn the element selector switch to the sodium side (left) or potassium side (right), whichever is to be determined.
8. Pipette 10 ml of the pure synthetic "50-50" nickel plating bath into a 100-ml volumetric flask and dilute to the mark with distilled water. Transfer a portion of this solution to a 100-ml beaker and place the beaker on the beaker shelf so that the glass tube of the atomizer extends into the solution.
9. Adjust the zero knob on the left for sodium or on the right for potassium until the pointer of the meter is on the zero line.
10. Lower the beaker so that none of the sample is entering the atomizer for about 10 seconds, and then replace it in position.
11. Again adjust the pointer of the meter to zero. This is the true setting. ("Whenever a solution is put in the instrument, the walls of the atomizer become covered with that particular sample, and subsequent solutions will be altered if care is not exercised to eliminate its effects. By placing the solution on the atomizer and setting the pointer, then removing it for a few moments, the solution just injected has an opportunity to diffuse through the previous one that still remains on the walls of the glass chamber6"). This procedure should be followed with every succeeding standard and sample.
12. Replace the beaker containing the pure nickel solution with a beaker of distilled water to rinse out droplets of the nickel solution.
13. As in step 8, dilute 10 ml of a pure synthetic "50-50" bath which contains 100 ppm of sodium and 100 ppm of potassium to 100 ml. The resulting diluted solution contains 10 ppm of each element. Transfer to a 100-ml beaker and place it on the beaker shelf.
14. Turn the ratio dial to 100, and by turning the range control in a clockwise direction, adjust the meter to read zero.
15. Repeat steps 10 and 11. The instrument is now calibrated. From time to time it will be necessary to

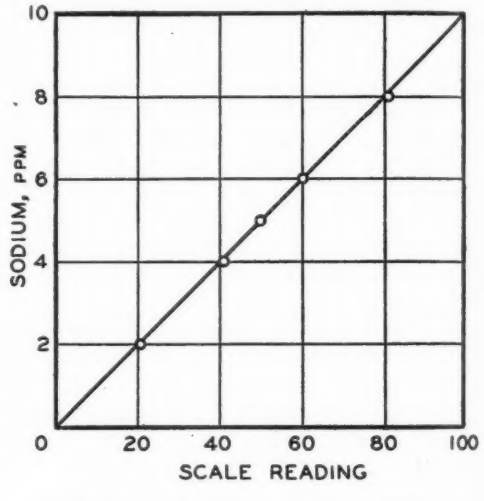

Fig. 1. Calibration curve for determination of sodium by means of Perkin-Elmer Flame Photometer

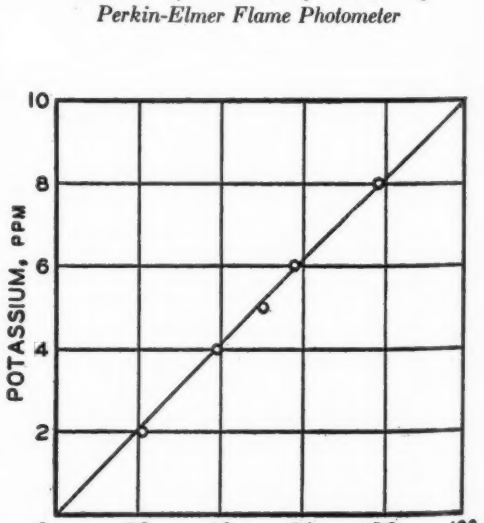

Fig. 2. Calibration curve for determination of potassium by means of Perkin-Elmer Flame Photometer

check the calibration settings and to correct for any drift that might have occurred.

16. Replace the standard solution with distilled water and let it run while preparing the sample.
17. Pipette 10 ml of the sample to be analyzed into a 100-ml volumetric flask and dilute to the mark with distilled water. Transfer a portion to a 100-ml beaker and place on the instrument.
18. Make the needle of the meter read zero by adjusting the ratio dial knob.
19. Replace the sample with distilled water.
20. Look up the ratio dial reading on the calibration curve and find the figure corresponding to it which represents the concentration of the element in the diluted sample.
21. Analyze additional samples by following the same procedure beginging with step 17.
22. Analyze for the other element by beginning with step 7.

Calculations

The determination of the sodium or potassium concentration in the original sample of bath is very simple. The figure obtained from the calibration curve gives the concentration of sodium or potassium in the diluted sample. Since the original sample had been diluted to ten times its volume, the concentration of the element in the diluted solution is one-tenth of its original concentration. Thus multiplying the figure obtained from the calibration curve by a factor of 10 gives the concentration of the element in the original sample.

For example, in an analysis of potassium a ratio dial reading of 73 was obtained. This reading corresponds to a concentration of 7.6 ppm of potassium in the diluted sample, and 7.6 x 10 = 76 ppm of potassium in the original sample.

Accuracy Attainable with the Method

In order to check the accuracy that may be expected when sodium and potassium are analyzed by this method, small amounts of various salts were dissolved in 200 ml of the pure synthetic "50-50" nickel plating bath. Table II shows the ions and the quantity of each that were added to the bath.

These ions were added as the solid chlorides, sulfates, or nitrates wherever possible. All the salts dissolved completely, except the calcium salt. The mixture was heated, shaken well, and cooled. It was then filtered to remove any undissolved salts, and the filtrate was used in preparing the solutions for the accuracy and precision tests. Standard solutions containing 10, 30, 50, 70 and 90 ppm of sodium and of potassium were made up as described previously under "Preparation of the Calibration Curve".

The procedure described under "Recommended Routine Procedure" being employed, single runs were made with these standard solutions to test the accuracy of the method. Table III shows results of fair accuracy over this range of concentrations, with average errors of about 6 per cent for sodium and 5 per cent for potassium and that the added ions have little effect upon the readings.

Precision of the Method

To test the precision of the method, a series of duplicates was run with the same bath that was used for the accuracy tests.

Although the results shown in Table IV tend to run high, duplication is quite good with average deviations of 0.5 ppm for sodium and 0.6 ppm for potassium.

Discussion

The following points were found to be critical in using the flame photometer for the analysis of sodium and potassium in nickel plating baths:

1. The 30-minute period for warming up the instrument is the absolute minimum.

2. Thorough washing of the atomizer is necessary after each run.

3. Frequent checking of the range control is necessary, with readjusting of the calibration settings as required.

4. For the protection of the flame photometer, the level of the water must be maintained not lower than the neck of the water cell.

a. e. s. research

5. Extreme care must be exercised in preparing and handling all standard solutions because appreciable quantities of sodium may be picked up from almost any place.

6. It is also advisable not to smoke in the vicinity of the flame photometer when tests are being made because tobacco

(*Continued on page 297*)

TABLE II. IONS ADDED TO NICKEL BATH

Ion	Quantity mg	Equivalent g/l
Aluminum	200	1.0
Cadmium	200	1.0
Copper	40	0.2
Chromium (as CrO_3)	40	0.2
Lead	10	0.05
Manganese	200	1.0
Iron	200	1.0
Silicon	200	1.0
Zinc	200	1.0
Calcium	(Saturated)	(Saturated)

TABLE III. ACCURACY OF FLAME PHOTOMETER METHOD

Sodium Added ppm	Average Dial Reading	Sodium Found ppm	Error %	Potassium Added ppm	Average Dial Reading	Potassium Found ppm	Error %
10	11	11	10	10	11.7	11	10
30	32	32	7	30	30.3	31	3
50	50.3	50.3	6	50	50	52	4
70	70.5	70.5	7	70	71	73	4
90	90	90	0	90	91	92	2

TABLE IV. PRECISION OF FLAME PHOTOMETER METHOD

Sodium Added ppm	Average Dial Reading	Sodium Found ppm	Potassium Added ppm	Average Dial Reading	Potassium Found ppm
50	52	52	50	50	52
50	51	51	50	51	53
50	52	52	50	50.5	52
50	52	52	50	51.3	54
50	51	51	50	51	53

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Book Review

by DR. HAROLD J. READ,
Associate Professor of Metallurgy
The Pennsylvania State College

JOURNAL OF THE ELECTRODEPOSITORS' TECHNICAL SOCIETY, Vol. 21, 1945–1946, edited by S. Wernick, 297 pages. The Electrodepositors' Technical Society, 27 Islington High Street, London, N. 1. Price, two guineas.

This collection of papers covers a wide range of subjects, and it will be possible to do little more in the space available here than to give the prospective purchaser some idea of the contents of the volume.

Two papers are concerned with alloy plating; one is on speculum metal and the other on zinc-tin alloys. Both are excellent contributions which contain a great deal of practical experimental data.

Of the four articles on metal finishing in the automotive industry, three are extremely short, and the fourth is a general discussion of the problems encountered in this field.

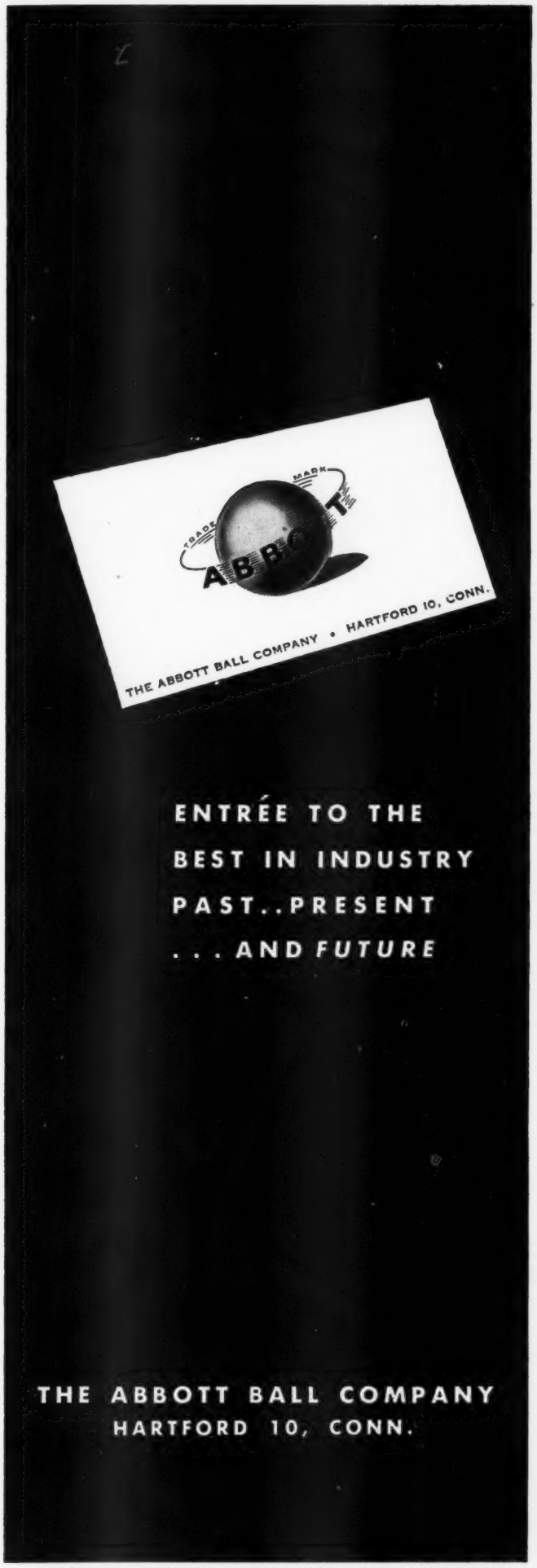
A paper on the electrogalvanizing of wire presents rather complete details of a process which appears to be quite similar to the Bethanizing process. The two articles on electrotinning will provide little new material for American readers since they are merely descriptions of the "Ferrostan" lines used by Carnegie-Illinois, and do not contain any material which is not available in American publications.

Polishing is the subject of three papers. One is a general review by C. L. Faust of the present status of electropolishing, and the other is an experimental paper on the electropolishing of carbon-manganese steels. The third article deals with traditional polishing techniques, and contains little or nothing in the way of new material.

The testing of deposits receives attention in a contribution on the determination of the thickness of chromium deposits by means of a drop test. This is an excellent bit of work which has been reported in some detail. Another timely paper deals with the surface condition and reflectivity of metals although, unfortunately, there is relatively little in the way of new data.

The remaining papers are of a miscellaneous nature, and deal with health hazards in the plating industry, plating in the U. S. A., defects in plating solutions and their remedies, plating on aluminum, and the dyeing of anodized aluminum. These are, in general, contributions of more than passing interest.

There is a considerable amount of noteworthy discussion on most of the papers, and this feature adds a great deal to the value of the book. The volume, while by no means free of typographical errors, is well printed with excellent illustrations, and is adequately bound.



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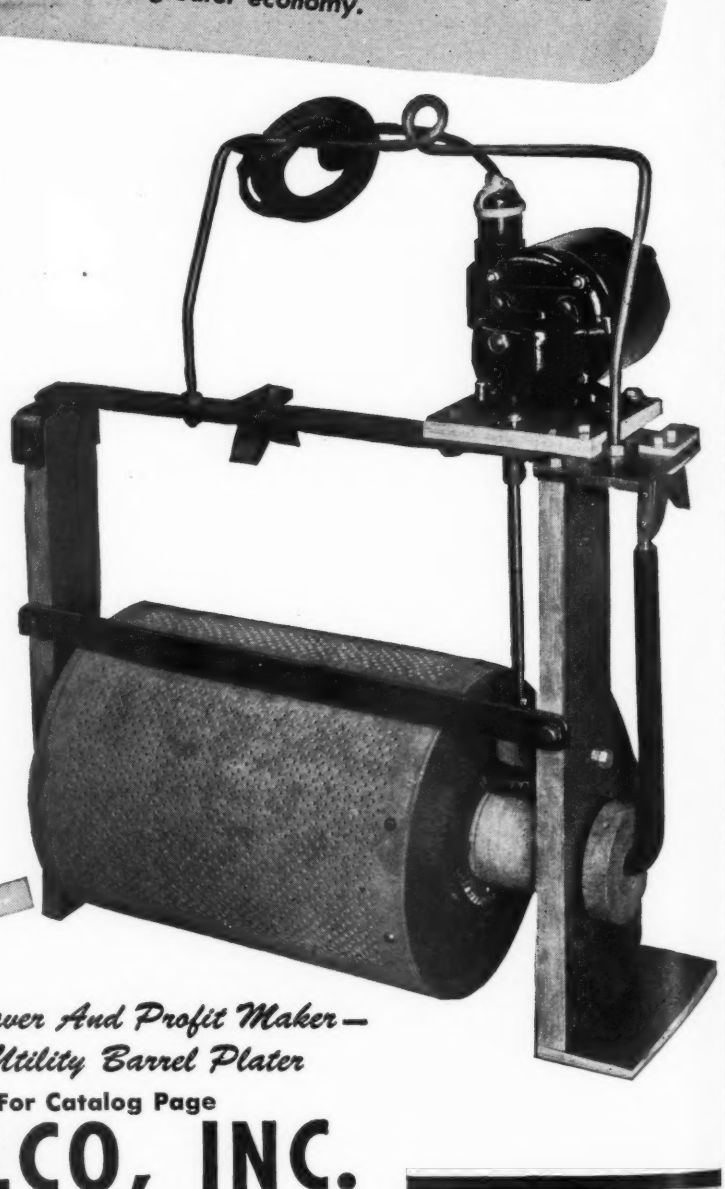

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The Question Box

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Q. 10. What addition agent system and concentrations are recommended for lead fluoborate plating baths?

A. The optimum addition agent system and concentrations for heavy deposits of lead are resorcinol, 0.4-0.7 oz/gal, together with glue or gelatin, 0.02–0.03 oz/gal.—R. A. SCHAEFER.

Q. 11. Does the throwing power decrease with increased current density, everything else being equal?

A. Yes, the throwing power decreases very rapidly with an increase in current density. For example, high speed silver baths have good throwing power at 10 to 20 amperes per square foot but at 100 to 150 amperes per square foot their throwing power is comparable to that in hard chromium plating, which is very poor.—R. A. SCHAEFER.

Q. 12. Can you give me a reference to any complete work concerning the electrodeposition of gold alloys?

A. We know of no comprehensive book on the subject. Our files indicate the following magazine articles and patents which it may pay you to consult: H. Krause, Metallwaren Ind. u. Galvano-Tech. 31, 271–273, 296–298, 319–320, 339–341 (1933); H. J. Kersten, U. S. Patents 1,905,105–6, April 25, 1933; E. Menzel and K. Kreidl, German Patent 526,745, November 9, 1926; E. Raub and K. Bihlmayer, Mitt. Forsch.-Inst. Probieramts Edelmetalle staat. hoheren Fachschule Schwab. Gmund **11,** 59–65 (1937); C. B. F. Young and V. E. Herschlag, Metal Ind. (New York) **38,** 194–196 (1940); G. Grube, Hereaus Festschrift **1930,** 34–44.—A. K. GRAHAM.

Q. 13. How can I remove weld scale from bright cold-rolled steel without affecting its lustre?

A. The method used for scale removal is, of course, determined by the type and thickness of the weld scale. Light, thin, blue oxide films may be removed successfully by making the parts cathodic at 30 to 50 asf for 30 to 45 seconds in a solution of sodium cyanide, 6 oz/gal, kept at room temperature. Heavier scale may require pickling in a 15 to 20 per cent by volume sulfuric acid solution with an inhibitor at 150° F or in a 50 to 100 per cent by volume muriatic acid with suitable inhibitor at room temperature. Extremely heavy scale, normally requiring long pickling, may be removed most successfully by means of the Bullard-Dunn process.—B. C. CASE.

A. By proper control of the welding operation, for example of pressure, contact time, and current in spot welding, the amount of weld scale can frequently be reduced to a minimum. Properly inhibited strong muriatic acid (50–85 per cent by volume, stronger acid giving irritating fumes), generally affects the lustre of low-carbon steel less than inhibited sulfuric acid. For highest degree of uniformity a suitable wetting agent may be added to the inhibited acid. Several advertisers in PLATING supply effective inhibitors and wetting agents specially compounded for this purpose. It is often necessary to rinse in hot water or dip in an uninhibited acid to remove the inhibitor before plating, —K. G. SODERBERG.

Q. 14. Can you give me the titles of up-to-date books on electroplating?

A. There are at least four books which should be in every plater's library. "Principles of Electroplating and Electroforming," by William Blum and George B. Hogaboom, 2nd Ed., 1930, published by McGraw-Hill Book Co., 330 W. 42nd Street, New York 18, N. Y., price $5.00, is probably the most complete book on plating. Later practices and views are covered in "Modern Electroplating," published by the Electrochemical Society, 235 W. 102 St., New York 25, N. Y., price $5.50. This book, like the following, is written by a number of authorities in their respective fields. "Plating and Finishing Guidebook," published by Finishing Publications, Inc., 11 W. 42nd Street, New York 18, N. Y., price $1.50, is a condensed handbook with special emphasis on solution formulas. "Fundamentals of Electrochemistry and Electrodeposition," by Samuel Glasstone, published by American Electroplaters' Society, P. O. Box 168, Jenkintown, Pa., price $2.50, supplies the basic knowledge for an understanding of plating processes.— A. K. GRAHAM.

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Q. 1. In regard to the best method for getting nickel to cover soldered joints on brass parts, you will be interested to know that Zialite nickel will plate directly, without a copper flash, on soldered brass or other metal, smoothly and completely with no distinction between the different metals.—A. M. WILSON, Zialite Corporation.

Q. 5. Following stripping silver from brass in a 19:1 sulfuric-nitric acid mixture, would it not be better to rinse in water and add salt to the recovery solution later than to rinse in salt water and get a precipitate of silver chloride on the work which will adhere in recesses, screw holes, etc., and be carried over into the rinse water?—GEORGE B. HOGABOOM, New Britain, Conn.

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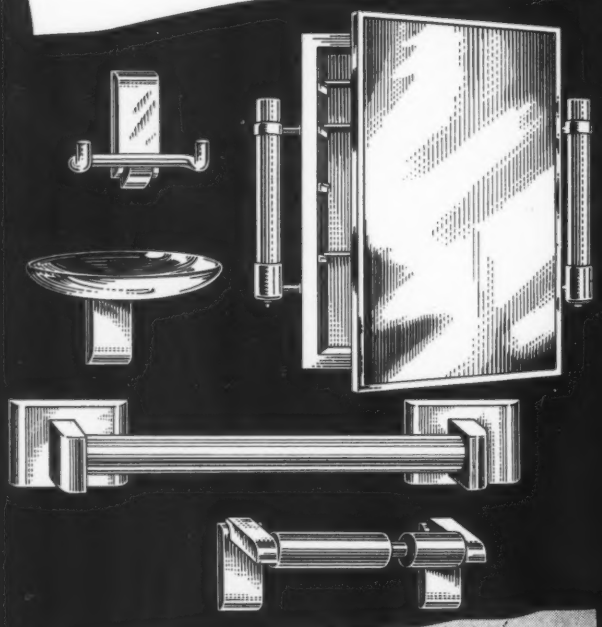

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Abstracts

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Arsenic as a Corrosion Inhibitor in Sulfuric Acid. A. Wachter, R. S. Treseder, and M. K. Weber. Corsion **3,** 406–414 (1947).
Concerned primarily with the inhibitive properties of arsenic compounds in strong sulfuric acid solutions on the corrosion of carbon steel. Experimental results are charted.

Zinc-Iron Couple in Water at Elevated Temperaature. George D. Lain. Corrosion and Material Protection **4,** 12–15 (July-August, 1947).
Discusses the possibility of a reversal in potential of the zinc-iron couple in natural waters at elevated temperatures with emphasis on the behavior of hot-dipped galvanized steel pipe in a natural water with a total hardness of less than 60 ppm, expressed as calcium carbonate, and carrying dissolved oxygen and carbon dioxide close to the point of saturation.

Report of Committee B-8 on Electrodeposited Metallic Coatings. Am. Soc. Testing Materials, Preprint 15 (1947), 7 pp.
Gives results of atmospheric exposure tests on copper-nickel-chromium deposits on high-carbon steel and on electroplated lead coatings on steel.

The Dissolution of Gold in Cyanide Solutions. P. F. Thompson. Electrochemical Society, Preprint 91–26 (1947), 27 pp.
The above process is first considered from a theoretical point of view, and then investigated experimentally. The results have value not only for the cyanidation of gold ores, but also for the information they provide concerning the corrosion of gold.

Tests for Hot-Water Resistance of Tank Enamels. Dwight G. Moore and William N. Harrison. J. Am. Ceramic Soc. **30,** 220–226 (July 1, 1947).
Resistance of a representative group of commercial enamels, designed esepcially for use on hot-water tanks, and of several non-tank enamels was measured by the following three types of test: loss of gloss after periods up to several hours in a conventional autoclave with distilled water; loss of gloss after one day to two weeks in apparatus which kept the specimens in contact with constantly changing, boiling distilled water; and loss in thickness after periods up to 5,000 hours in a modified autoclave with circulating aerated tap water under pressure. The tests are described in detail, comparisons are made, and the loss-of-gloss test used in Commercial Standard CS115–44 is discussed.

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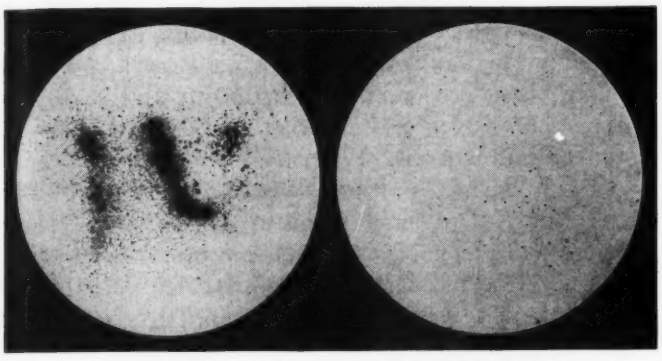

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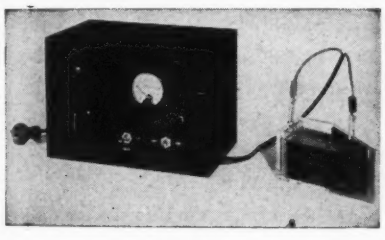

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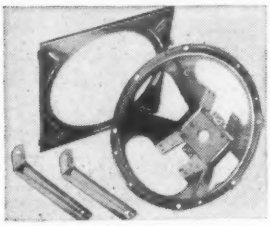

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Surface Treating Aluminum for Corrosion Resistance and Finish Adhesion. Anon. Modern Metals **3,** 16–18(December, 1947).
A description of the Alodine process as used by Minneapolis-Honeywell in the manufacture of precision recording instruments and control systems.

Effect of Composition, Heat Treatment, and Cold Work on the Hydrogen Embrittlement of Stainless Steel Wire During Cathodic Pickling. Carl A. Zapffe and O. George Sprecht, Jr. Trans. Am. Soc. Metals **39,** 193–212 (1947).
Second in a series of investigations exploring, by use of a new test, the nature of hydrogen embrittlement and the factors controlling it. Concerned specifically with three predominating factors involving only the metal itself: composition, thermal treatment, and mechanical treatment. Stainless and plain carbon steels were studied. Graphs of the experimental results show clearly relative susceptibilities of different types of steel under conditions of equal concentration of surface hydrogen, effect of heat treatment, effect of cold work, and general progress of embrittlement with increasing charging time. 11 ref.

Acid Composition, Concentration, Temperature, and Pickling Time as Factors in the Hydrogen Embrittlement of Mild Steel and Stainless Steel Wire. Carl A. Zapffe and M. Eleanor Haslem. Trans. Am. Soc. Metals **39,** 213–240 (1947).
Third in series explores by means of the constant-rate, single-bend test, the variables that affect the hydrogen embrittlement of steel. Specifically concerned with factors operative in straight acid pickling without addition of inhibitors. Variables investigated were: composition, thermal treatment, and mechanical treatment of the steel; composition, concentration, and temperature of the acid; and pickling time. Six different acids were studied. Master graphs were developed which reveal the relationships of the seven variables.

Copper-Titanium Alloy Coatings on Mild Steel. Edward J. Chapin and Carle R. Hayward. Trans. Am. Soc. Metals **38,** 909–956 (1947).
Gives results of an exploratory study on the coating of mild steel with copper-titanium alloys of several compositions by the application of heat in a protective atmosphere. Methods used are described. Compositions ranging from 5 to 37.5 per cent were investigated. The most satisfactory coating was found to be of approximately eutectic composition or about 25 per cent Ti content. Observations on metallographic examination, micro-hardness determinations, bend, corrosion, diffusion, and nitriding are presented. 12 ref.

Mechanical Properties of Chromium Diffusion Coatings. (In English) N. S. Gorbunov, I. D. Yudin, and N. A. Izgaryshev. Compt. rend. Acad. Sci. U R. S. S. **55,** No. 5, 415–417 (1947).

Reports some results obtained in studying the microhardness of chromium diffusion coatings on metals with different carbon contents. The layers of chromium were produced on the surface of steel and cast-iron specimens in a chlorine atmosphere by a method described elsewhere. It was found that a diffusion coating did not differ appreciably in hardness from the bulk material.

Anodic Reactions of Aluminum and Its Alloys in Sulfuric and Oxalic Acid Electrolytes. Ralph B. Mason and Charles J. Slunder. Ind. Eng. Chem. **39,** 1602–1607 (1947).
Electrolytes used at elevated temperatures or in a more concentrated form and at low current density tend to produce oxide coatings of lighter weight. The electrolyte must be sufficiently agitated to remove the heat developed at the aluminum anode, otherwise the oxide coating is dissolved. Long-time treatment in the electrolyte brings about a decrease in the efficiency of oxide coating formation, the highest efficiency being obtained with pure aluminum.

Full Automatic Hot Zinc Galvanizing of Tanks. Raymond F. Ledford. Iron Age **160,** 56–60 (July 31, 1947).
Explains the advantages of full automatic methods, describes several interesting examples of conveyorized tank-galvanizing installations, and comments on make-up and other characteristics of baths for mechanized operations.

Wet Grinding Sheet and Strip. T. E. Lloyd. Iron Age **160,** 65–66 (August 14, 1947).
Describes a new finishing machine which will simultaneously wet grind both sides of cut or coiled sheet or strip. This unit will grind, polish or buff carbon and stainless steel, clad metal, magnesium, aluminum, or plastics.

Electrolytic Polishing of Magnesium II. George Black, Metal Finishing **45,** 84–86 (July, 1947).
Outlines results of some experiments on the adaptation to production processes of Jacquet's method for electrolytic polishing prior to metallographic examination.

Surface Protection and Sprayed Metallic Coatings for Aluminum Alloys. E. Lecuona. Tecnica Metallurgica **3,** 354–358 (1947); Light Metals Rev. **6,** 468 (1947).
Comprehensive exposure tests in America on the preparation of aluminum surfaces for painting have indicated the advantages of the Alrok or Alumilite processes. Owing to its hardness, chromium plating of aluminum would be of particular advantage on rapidly rotating aluminum helices. Experiments are still being continued on chromium and cadmium plating. A suggested use of chromium plated aluminum is for generator commutators. Electrical pistols for

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spraying of aluminum are under consideration but have not been developed commercially as yet.

Protection Against Corrosion of Zinc and Zinc Alloys Having Bright Metallic Surfaces. H. D. v. Schweinitz and G. Wassermann. Metallwirtschaft **21**, 49–50, 750–754 (1942).

Gives details of the development of a protective coating for zinc which does not obscure its bright metallic appearance. Three methods were investigated: treatment with an alkaline chromate solution was quite effective as shown by tests under a number of exposure conditions; treatment with sulfide solutions gave very little protection; the most satisfactory results were obtained by treatment with dilute sodium silicates (water glass). The latter treatment was especially suitable for aluminum-containing zinc alloys.

Determination of Porosity of Non-Conducting Coatings, Especially Phosphate Coatings on Steel. W. Machu. Korrosion u. Metallschutz **20**, 6–11 (1944).

Discusses theory underlying the electrochemical test method described for porosity of non-conducting coatings. The accuracy of results obtainable by the proposed methods was checked by four different methods. It may be used to follow the aging of zinc phosphate baths and for the study of phosphating processes.

Corrosion Resistant Cements in the Plating Room. Vincent A. Curil. Corrosion and Material Protection **4**, 19–20 (July-August, 1947).

The major problem of many plating rooms, the handling of corrosive solutions without causing pitting and erosion of floors, destructive attack in drains and developments of leaks with resulting loss of solution from pickling and plating tanks, is discussed. How it can be overcome and why it is important are outlined

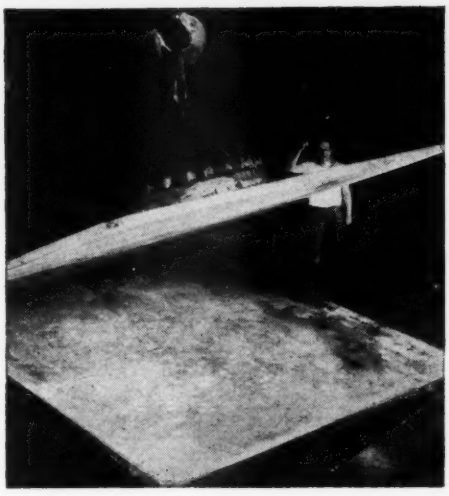
Royal Dichrome Process. Anon. Eng. Mats. and Proc. **5**, 58 (June, 1947).

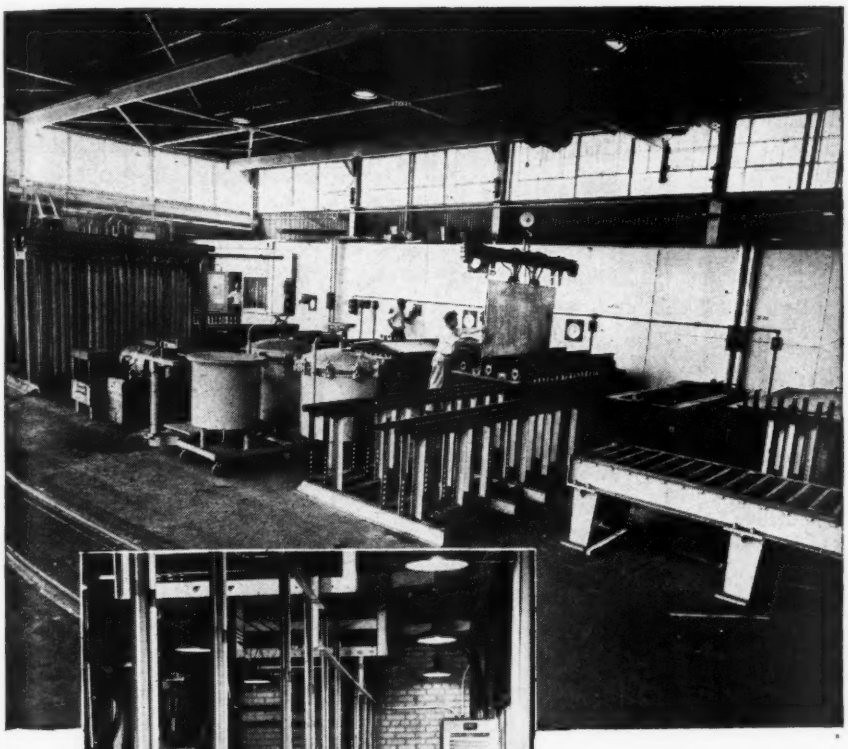
Describes new British process for surface treatment of zinc-base die castings prior to chromium plating. Its use eliminates the necessity for an intermediate metal layer.

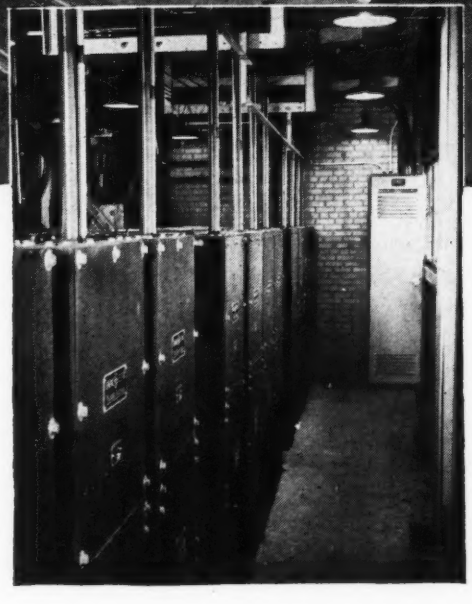
Metal Surfacing by Hard Chromium Plating. Edwin H. Halvorsen. Metal Finishing **45**, 71–76 (July, 1947).

Discusses decorative and hard chromium plating; cemented tungsten carbide, stellite, tantalum, and titanium carbide tools; and chromium-plated high-speed steel tools. Gives results of tests on surfaced and unsurfaced molybdenum high-speed steel gear-shaper cutters, which indicate a large increase in tool life for the former.

Lukens Steel Company Uses G-E Copper-Oxide Rectifiers with Precision Control for Plating







Controls — conveniently located on panel next to tank — give operator finger-tip voltage control. Pressing RAISE or LOWER buttons increases or decreases voltage instantaneously to desired value.

Bank of General Electric copper-oxide rectifiers and automatic "on-load" control maintain selected voltage within ± 2 per cent of selected value.

Why not look into the benefits — and savings, too — of a completely automatic General Electric copper-oxide rectifier "package." Write us for information, or ask to have a representative call. Section A2-358, General Electric Company, Bridgeport 2, Connecticut.

The electrolytic plating of nickel on stainless and Inconel is a closely controlled process in the manufacture of Lukens Stainless-Clad and Inconel-Clad steels. These clad steels depend upon this plating to insure adequate bonding of these corrosion-resistant metals to the steel backing plates. After preliminary assembly, hot rolling permanently bonds the components and reduces the thickness to prescribed dimensions.

Utilizing a total of 16,000 amperes, the Lukens plating plant carries out this heavy-duty operation with 12 General Electric copper-oxide rectifiers, controlled by General Electric automatic "on-load" controls. Maintaining voltage with an accuracy of ± 2 per cent, these controls keep constant watch over all operations. For easy maintenance, all rectifier units are located outside the plating room; for easy operation, push-button controls are located right at the tanks.

When you're thinking of modernization, think in terms of convenient, automatic control. A typical automatic unit — consisting of a General Electric "2000" copper-oxide rectifier, an operator's control box, and an automatic induction-type "on-load" control — handles 12 kw with push-button flexibility, precision voltage control. Combinations of G-E "2000" rectifiers — or other General Electric models — can be made to give you exactly the power you need, with the fine control you want.

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SULFATE TEST SET

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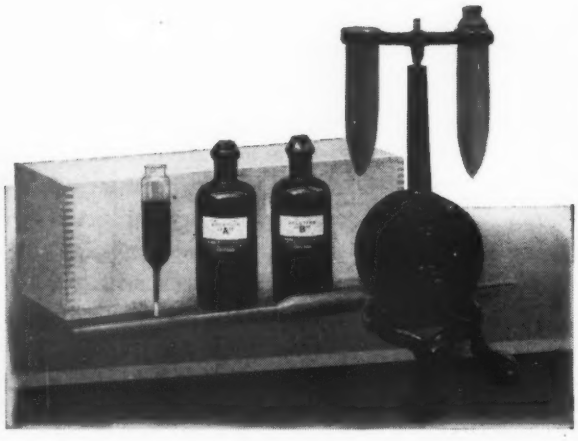
Sulfates in Chromium Solutions



This apparatus enables anyone to accurately and quickly determine the sulfate content of a chromium plating solution.

For consistently good plating results, the ratio of sulfates to chromic acid must be maintained within very definite limits so that a constant check must be kept.

This is easily accomplished with this equipment and we can also supply sets for quickly ascertaining the chromic acid and trivalent chromium content.

We also manufacture test sets for analyzing other plating solutions, cleansers, pickles, anodizing baths, for determining the thickness of zinc, cadmium, copper and tin deposits and for pH determination.

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Patents

By GEORGE B. HOGABOOM
Consultant, New Britain, Conn.

No. 2,431,949, December 2, 1947—Apparatus for Electroplating the Inside of Bearing Shells and the Like —W. M. Marz, assignor to General Motors Corporation.

CLAIM 1. An apparatus for electrodepositing metal on the inside of bearing shells and the like, a first tank containing a supply of electrolyte, a pressure tank, a pump for pumping electrolyte from the first tank to the pressure tank, a plurality of pipes leading from the pressure tank, a plurality of hollow supports above the first tank, each of which is adapted to support a stack of bearing shells forming a tubular cathode and each of which receives electrolyte through one of the pipes, a tubular anode of insoluble material within each of the stacks of bearing shells, spaced therefrom and extending downwardly through a hollow support, a cap member for the upper end of each of the stacks of bearing shells and being spaced from one end of the tubular anode within the corresponding stack of bearing shells, the arrangement of each hollow anode, stack of bearing shells, and cap thus being such that electrolyte is caused to flow upwardly in the space formed by an anode and stack of bearing shells until it reaches the top of said stack and then is directed by the cap downwardly into and through the hollow anode for return to the first tank, a plurality of anodes of the metal to be electrodeposited on the bearing shells disposed in the electrolyte in the first tank, a porous cup adjacent each last mentioned anode, a cathode within each porous cup, and electrical connection from the positive side of a source of direct current to each of the last mentioned anodes, from each of the last mentioned cathodes to each of the hollow anodes, and from each of the stacks of bearing shells to the negative side of the source of direct current whereby as metal is electrodeposited onto the inside of the stacks of bearing shells a corresponding amount of metal goes into solution in the electrolyte in said first tank.

3 claims.

REFERENCES CITED IN FILE: U. S. Patents Nos. 742,443, October 27, 1903, to Johnson; 746,748, December 15, 1903, to Schwartz; 899,226, September 22, 1903, to Lutz; 1,982,009, November 27, 1934, to McKinney; 588,740, August 24, 1897, to Becker; 1,467,202, September 4, 1923, to Slatineanu; 2,137,806, November 22, 1936, to Paige; 631,040, August 15, 1899, to Greenawalt; 1,371,414, March 15, 1921, to Edison; 57,412, August 21, 1866, to Van der Weyde; 1,372,928, March 29, 1921, to Barton; 1,861,446, June 7, 1932, to Maag; 908,937, January 5, 1909, to Baylis et al.;

A New Horizon for Metal Finishing

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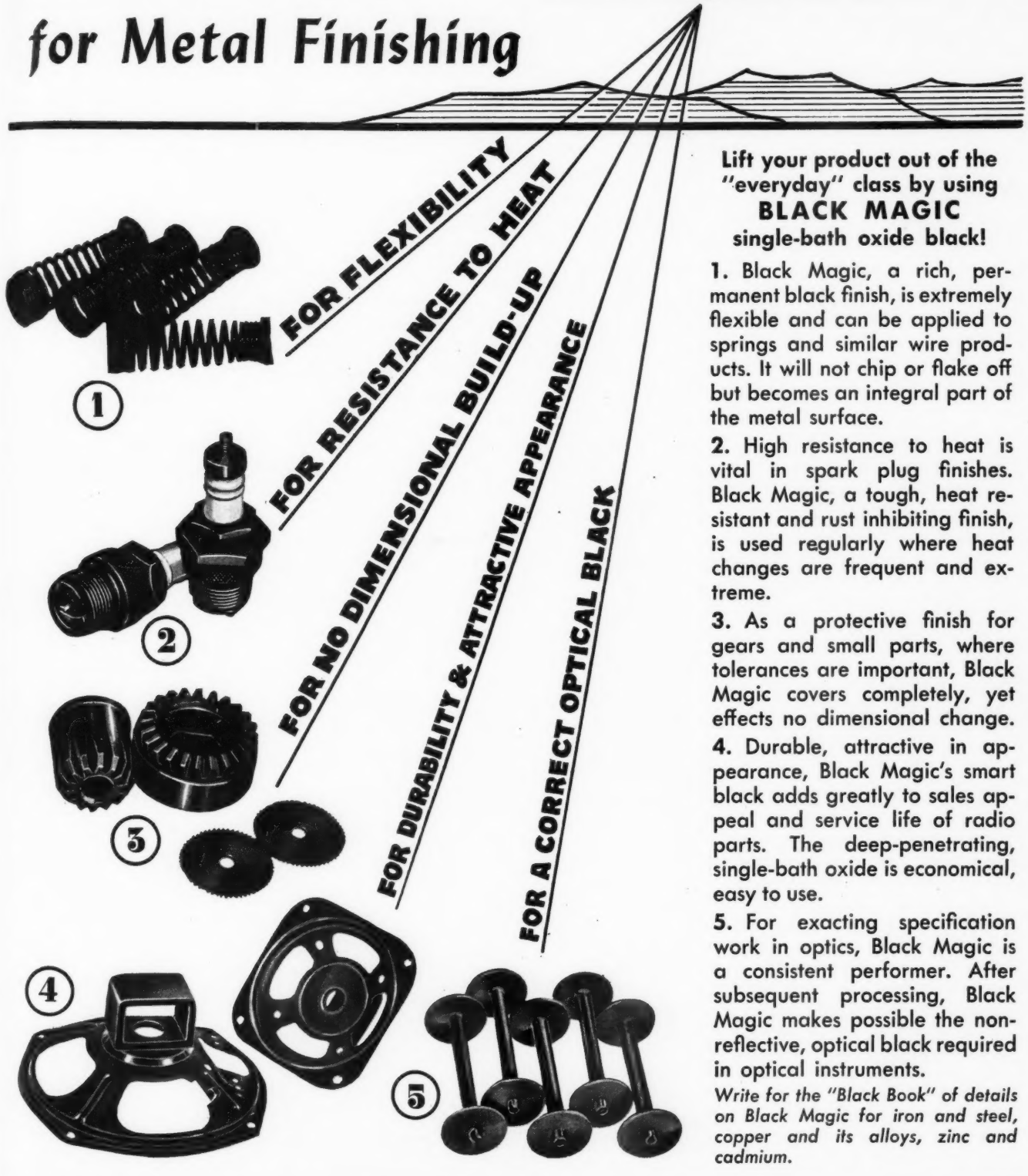

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3. As a protective finish for gears and small parts, where tolerances are important, Black Magic covers completely, yet effects no dimensional change.

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5. For exacting specification work in optics, Black Magic is a consistent performer. After subsequent processing, Black Magic makes possible the non-reflective, optical black required in optical instruments.

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HEAT TREATING SALTS, CLEANERS, ETC.

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A 175.

1,927,162, September 19, 1933, to Fiedler et al.; 2,086,-841, July 13, 1937, to Bagley et al.; 1,796,651, March 10, 1931, to Harty et al. British Patent No. 312,598, May 27, 1939. French Patent No. 825,071, November 27, 1937.

Field, *The Principles of Electro-Deposition.* Longmans, Green & Company, New York, 1911. "Electrolytic Method" on pp. 150–151.

No. 2,432,322, December 9, 1947—Apparatus for Electroplating Articles Having Pockets on Recesses Therein—J. V. Lundstrom, assignor to General Electric Company.

CLAIM. Am electroplating apparatus comprising a tank for holding electrolytic bath, a disk of insulating material mounted therein for rotation about a horizontal axis, a metal bracket secured to said disk and flexibly connected to a stationary, insulated conducting rod extending through said disk, said stationary rod being connected to one pole of a source of electric current, said bracket being provided with a socket for detachability and rigidly supporting the article to be plated at one end thereof for rotation about the axis of said disk during the plating operation, and means for completing an electric circuit through said tank, electrolytic bath, article and bracket.

REFERENCES CITED IN FILE: U. S. Patents Nos. 615,940, December 13, 1898, to Wright; 986,823, March 14, 1911, to Heaphy; 1,036,571, August 27, 1912, to Corey; 1,154,604, September 28, 1915, to Boissier; 1,733,404, October 29, 1929, to Fahrenwald; 1,747,165, February 18, 1930, to Eaton; 1,861,272, May 31, 1932, Hildorf et al.; 1,950,096, March 6, 1934, to Yeager; 1,956,625, May 1, 1934, to Ritter; 2,351,321, June 13, 1944, to Compton; 2,382,233, August 14, 1945, to Kivley, et al. British Patents Nos. 304,029, January 17, 1929; 323,947, January 16, 1930; 412,685, July 5, 1934.

J. Electrodepositers' Tech. Soc. **13** (1937), p. 3 and Figs. 4 and 5 of Paper No. 7.

No. 2,433,441, December 30, 1947—Electrolytic Production of Thin Metal Foil—C. Davidoff, assignor to M. Swift & Sons, Inc.

CLAIM 3. In the electrolytic production of thin metal foil by making an endless band of polished stainless steel the anode in an alkaline electrolytic bath to passivate the band and maintain it in condition for clean stripping, electroplating the metal on the surface of the treated band, applying a filmforming material in a solvent directly to the electroplated metal, drying the film-forming material, and subsequently mechanically stripping the composite strip of metal and film from the endless band in foil form, the steps

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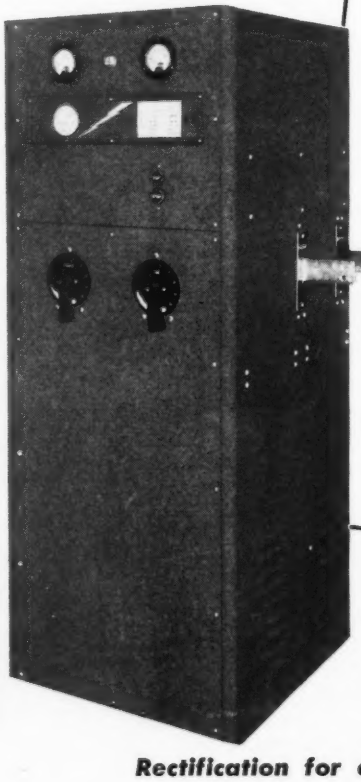

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*Patent Nos. 2,027,863; 2,094,650
1,573,961; Re. 19,894; 2,140,280

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comprising preparing the stainless steel band by first brushing and then buffing same to obtain a surface having a mirror finish, anodically treating said surface in an alkaline electrolytic bath to passivate the band and maintain it in condition for clean stripping, and plating to a thickness of between about 0.000001 and 0.000015 inch on the treated surface.

3 claims, 1 diagram, 20 cited references.

LEGEND: The metal foil so produced may be of gold, silver, copper, nickel or alloys of such metal, or substantially any metal or alloy which may be deposited from a plating bath.

No. 2,433,384, December 30, 1947—Method of Manufacturing Unitary Multiple Connections—E. S. McLarn, assignor to Standard Electric Corporation.

CLAIM 1. The method of manufacturing unitary multiple connections comprising the steps of printing with a conducting ink on a non-conducting sheet of a facsimile consisting of areas presenting the multiple connections and of areas presenting interconnections between each pair of connections and between at least one of said connections and the edge of the non-conducting sheet, then electroplating the inked areas of said sheet, the second mentioned areas being adapted to provide electrical series-connection for all of said multiple connections during the electroplating step, severing said interconnections thereby disconnecting electrically each of said multiple connections from the other connections, and punching holes in said first mentioned areas to receive terminals external to the sheet.

6 claims, 1 diagram, 12 cited references.

No. 2,434,855, January 20, 1948—Process of Coating Metal Articles—J. L. Teron Kosterlitzky, Guadalajara, Mexico.

The present invention has reference to a solid stable composition, which can be used for nickel plating metals of any kind, for the production of a plating upon such metals which has the appearance of high-grade nickel plating, strongly adherent to the metal, having good wear-resisting properties and exhibiting good brilliancy.

With metallic zinc present in the composition, no electric current from an outside source is needed. But in the modification in which the zinc is omitted, an electric current is also used.

CLAIM 1. The herein described process of plating an article made of metallic material which contains copper as a substantial constituent, which comprises rubbing upon the surface of such articles, with an applicator which is wet with an aqueous liquid, a mixture containing:

	Parts
Ferrous chloride and stannous chloride	22
Metallic zinc in powder form	about 10
Potassium bitartrate	15–25
Ammonium chloride	7–12
Nickel sulfate	21–35
Nickel ammonium sulfate	41–59
Sodium chloride	4.5–7.5

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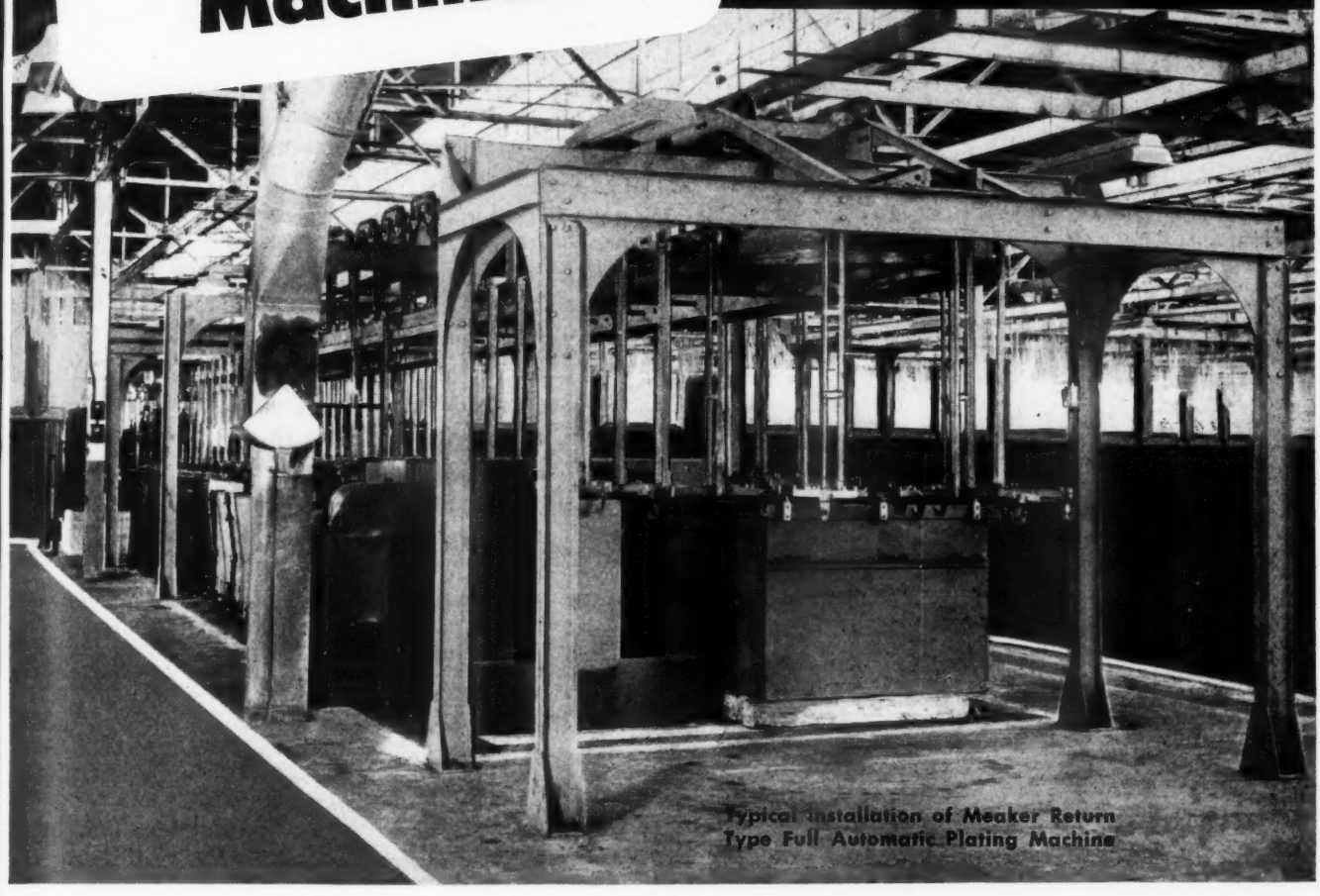

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such composition, when in powdered dry form, being substantially stable in air of ordinary moisture content.

3 claims, 6 cited references.

No. 2,434,286, January 13, 1948—Method of Forming a Point at the End of a Wire—W. G. Pfann, assignor to Bell Telephone Laboratories, Inc.

CLAIM 1. The method of shaping an electrical contact wire which comprises immersing one end of the wire below the free surface of an aqueous solution of potassium hydroxide to form a meniscus at the surface of said solution, applying an electrical potential to said wire to cause the etching thereof by electrolytic action and the formation of a symmetrical point in the region of said meniscus and adding a soluble copper compound to said solution for the purpose of sustaining said meniscus while the symmetrical point is being formed.

CLAIM 2. The method of forming a point at the end of a tungsten contact wire which comprises immersing a section at one end of the wire in a 25 per cent solution of potassium hydroxide in water to form a meniscus around said wire at the point of entrance at the surface of the solution, anodically treating the immersed wire below the region of said meniscus to form within the region of said meniscus a symmetrical point on said wire, and having copper dissolved in said solution to stabilize said meniscus during formation of said point.

3 claims, 4 figures, 8 cited references.

No. 2,434,417, January 13, 1948—Small Parts Holder for Electrolytic Baths—H. W. Kugler, assignor to Cherry Rivet Company, Los Angeles, Calif.

The invention is particularly applicable to the construction of a container for small objects that are subjected to anodic oxidation, anodic pickling, or cathodic plating, etc.

An object is to provide a simple construction for a holder for rivets or other small articles . . . which will operate so as to insure intimate contact between the superficial area of the rivets held in the basket.

CLAIM 3. In a holder for articles to be immersed in an electrolytic bath or the like, the combination of a container for the articles, having a peripheral wall and a bottom, a mandrel secured to the bottom and extending substantially centrally up through the container, a tubular flexible wall disposed around the mandrel, an expansible packer in the form of a roll of sheet metal with overlapping edges enveloping the tubular flexible wall, means attached to the mandrel for supporting the upper edge of the expansible packer, means for supporting the upper end of the mandrel, there being a duct extending down through the same and through the mandrel with lateral ducts within the mandrel for conducting fluid pressure to the inner side of the flexible tube to force same against the packer.

5 claims, 2 figures, 7 cited references.

Industry News

Water Demineralization by Ion Exchange Described in Color Movie. A new 16 mm. sound movie in color entitled, "Water, Water Everywhere," has just been produced by the Ion Exchange Products Department of American Cyanamid Company. It is devoted to an explanation of what ion-exchange resins are, how they work, and what advantages demineralization by ion-exchange offers various industries. The principles of ion-exchange are illustrated by animated drawings; batches of the ion-exchange resins manufactured by the company are followed through research, pilot-plant, and commercial-scale production; various demineralizers are shown in operation; and the uses for demineralized water in a number of industries are illustrated. The movie runs for twenty-three minutes.

Prints are available without charge or obligation for showing before meetings of industrial staffs, technical societies, and university students. Requests should be addressed to American Cyanamid Company, Ion Exchange Products Department, 30 Rockefeller Plaza, New York 20, N. Y.

Grant Advertising, Inc., has been appointed advertising and public relations counsel for the Udylite Corporation and its Parker Wolverine Division, according to an announcement by L. K. Lindahl, president. Udylite is a leading producer of electroplating equipment and supplies.

The initial advertising campaign is designed to emphasize the advantages of precision plating, not only for sales appeal but also for long life and efficiency of the product. Actual applications in automotive, appliance and radio fields will be featured.

New Minneapolis-Honeywell Branch in Wichita, Kans. A branch office serving Wichita, Kans., and surrounding territory has been opened by the Minneapolis-Honeywell Regulator Company at 1514 East Central, Wichita, Kans.

The Manager for the new branch is Lynn H. Johnson, Jr., who has been Sales Manager of the company's Gas Controls Division until his latest promotion. Other personnel include Donald D. Baker, Sales Engineer for the Industrial Instrument Division; Robert F. Perkins, Sales Engineer for the Heating Controls Division; and Robert F. Jamison, Air Conditioning Controls Sales Engineer. Lloyd Taylor will be in charge of air-conditioning controls service and installation.

United Chromium, Inc., Moves Los Angeles Branch Office. Moving of its Los Angeles offices and warehouse to 923 E. Third Street, Los Angeles 13, Calif., has been announced by United Chromium, Incorporated. According to District Manager R. J. Wooley, this central location will facilitate service on orders for "Unichrome" finishing and maintenance materials, and also technical service on metal finishing problems.

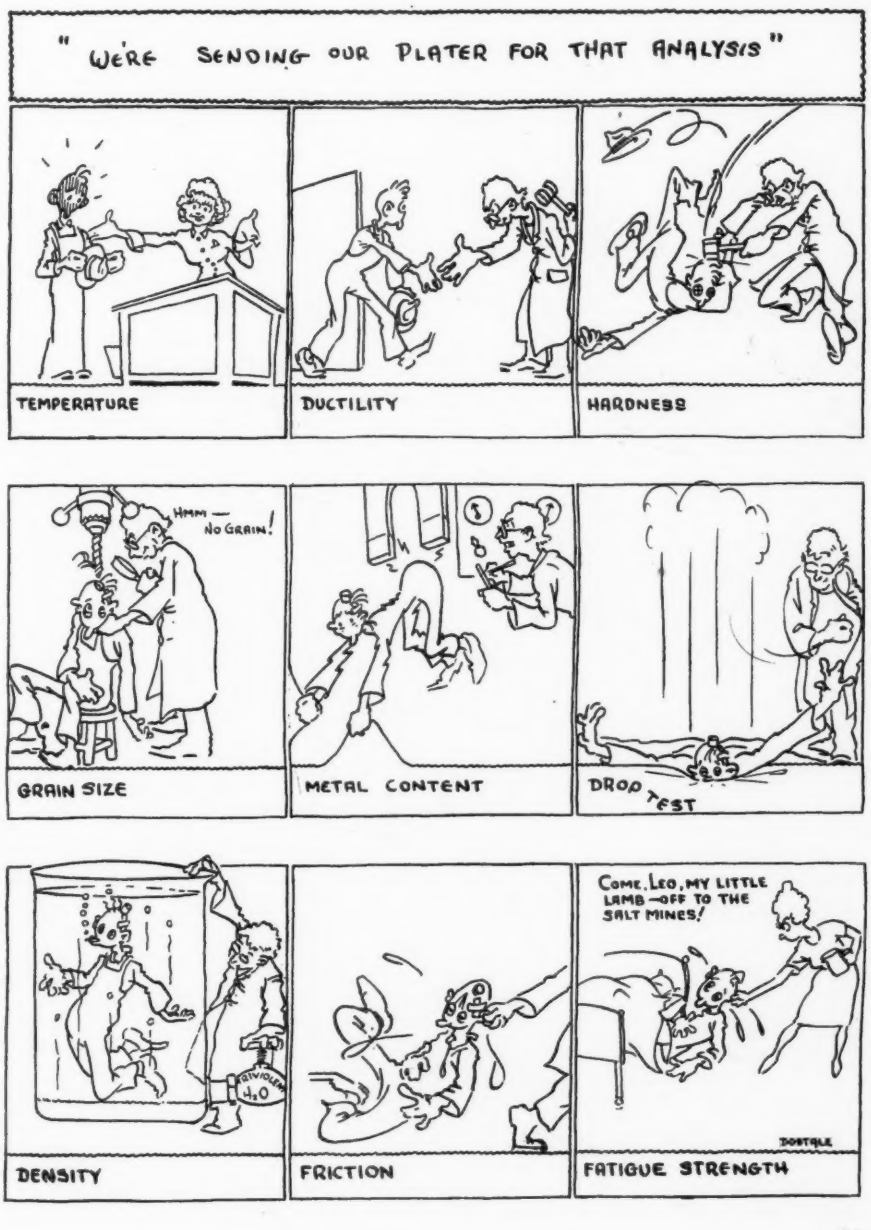
Stone and Webster, Incorporated, has acquired E. B. Badger & Sons Company for the purpose of expanding the engineering and construction activities of its subsidiary, Stone and Webster Engineering Corporation, in the process and industrial fields.

E. B. Badger & Sons Company is an old and established process engineering and construction concern of world-wide reputation, having originated over one hundred years ago in Boston, Mass., where its head offices are presently maintained.

The Stone and Webster organization, originally formed in 1888, has long been known for its engineering and construction operations, as well as for the advisory services it furnished to public utility and industrial clients and for its investment banking activities.

The Badger and Stone and Webster organizations will, at least for the time being, continue to operate as individual entities.

Job Shop Operations. According to the January issue of "The Monthly Bulletin" of the Masters' Electro-Plating Association, 123 William Street, New York 7, N. Y., the rate of operation of its members during January was 50½ per cent against 58½ per cent during December, 1947 and 74½ per cent during January, 1947. The average for 1947 was



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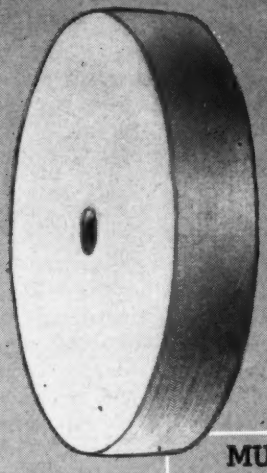

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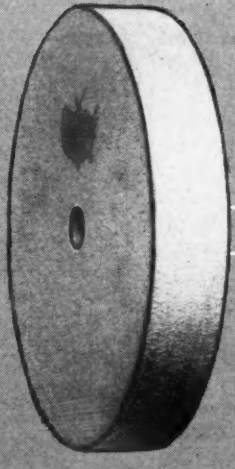

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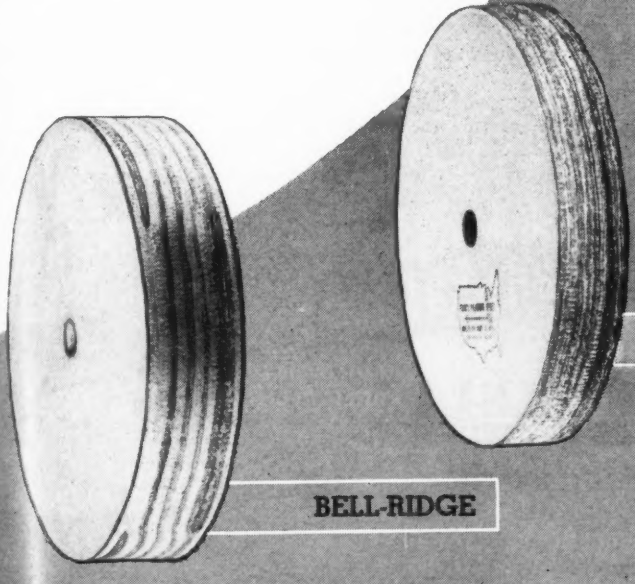


SHEEPSKIN

PRECISION MADE

BELL-RIDGE

American Buff Company

Main Plant and Offices

2414 SOUTH LA SALLE STREET • CHICAGO, ILLINOIS

ADV. BY S. K. LOVETT CO.

59 per cent compared to 78 per cent in 1946.

Of the over one hundred job shops that were started during the past two or three years in New York Metropolitan District, many have already fallen to the wayside and more are said to be ready to follow.

Brown Company Opens Memphis Office. Brown Instrument Company has opened a new district office at 922 Dermon Building, Third and Court Streets, Memphis, Tenn., it was announced last month by W. H. Steinkamp, Field Sales Manager for the Industrial Division of Minneapolis-Honeywell Regulator Company.

The opening of the Memphis district office marks the third move of a similar nature since the first of the year. Other offices have been established at Denver and Salt Lake City.

The Cowles Detergent Company, Cleveland, Ohio, is pleased to announce the appointment of the **Sessions-Gifford Company, Inc.,** of Providence, R. I. and Boston, Mass., as distributors of the complete Cowles line of alkaline and emulsion solvent type metal cleaners. Members of the experienced and competent sales organization of this old established chemical distributor will cover all of the New England states. Sessions-Gifford Company will maintain complete stocks of Cowles metal cleaners at convenient locations in this area and the technical service for which Cowles is noted will be available on request. Also, the services of the Cowles Metal Cleaner Laboratory in Cleveland will be available to all Sessions-Gifford customers without obligation.

New Reynolds Color Movie Details Aluminum Production. Said to be the first color motion picture to show the production of aluminum from raw bauxite to finished products, "Pigs and Progress" has just been released by the Reynolds Metals Company, Louisville 1, Ky. An interesting commentary by the well-known radio announcer, Andre Baruch, explains each of the scenes and processes. A specially written musical score played by a full symphony orchestra furnishes appropriate background music.

The picture is 16-mm with sound track is being made available without charge for showings before interested groups. Requests for use of the film should be made to the Advertising Department of the Reynold Metals Company, 2000 S. 9th Street, Louisville 1, Ky.

EXPERIENCED
ELECTRO-PLATER

High school education or better preferred. Practical experience essential. To supervise plating standard hardware plated finishes on small steel parts. *Reply to:*

P-2C PLATING
P. O. Box 168, Jenkintown, Pa.

Fumes out... production up!

AT TROY SUNSHADE CO., TROY, OHIO

An old, inadequate fume removal system has been put in the shade by a new, efficient KIRK & BLUM Engineered System installed in the pickling and plating rooms of Troy Sunshade Co. Individual hoods sweep a curtain of air across each fume-producing tank, pick up irritating fumes before they can affect the efficiency and health of plating employees.

No matter how large or small your plating operations, Kirk & Blum Engineers can design a system that will keep fumes OUT . . production UP, in your plant. Write for descriptive booklet "Fan Systems for Various Industries." The Kirk & Blum Mfg. Company, 2887 Spring Grove Ave., Cincinnati 25, Ohio.

Fume exhaust and blower enclosure. Note clean, compact lines.

FOR CLEAN AIR . . . THE INVISIBLE TOOL

KIRK AND BLUM

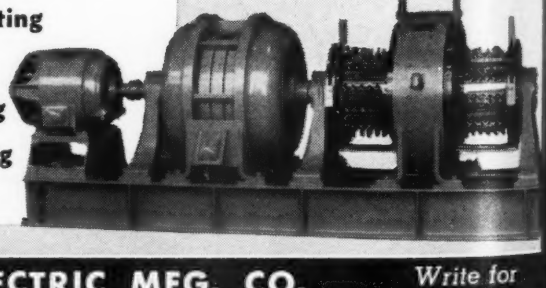
FUME CONTROL SYSTEMS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 184.

Motor Generators by COLUMBIA

There's a Columbia M-G Set available for your needs, whether you have a small plating bath or a large continuous strip plating line. Capacities up to 20,000 Amperes; 6 Volts and up. Dependable, performance proved, for many years. Your inquiries solicited.

For Electroplating
Anodizing
Electrocleaning
Electropolishing



COLUMBIA ELECTRIC MFG. CO.
4533 HAMILTON AVE. CLEVELAND 14, OHIO

Write for Catalog PL-700

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 185.

Personals

Edwin C. Rinker has been appointed Director of Sales and Engineering for the State of New Jersey, according to an announcement by Morris M. Messing, president of Bart-Messing Corporation. 45 Morgan Avenue, Brooklyn 6, N. Y., manufacturers of "Sel-Rex" selenium rectifiers.

After graduating from Pratt Institute in 1929 as industrial chemical engineer, Mr. Rinker joined the Yonkers, N. Y., division of Otis Elevator Company, where he was in charge of control of electroplating solutions and other chemical treatments. From 1930 to 1936 he developed electrolytes for precious metal plating for the Baker Company, Newark, N. J. From 1936 to 1945, while associated with Oakite Products, New York, he carried out research work on detergents. He then joined the Kellex Corporation and assumed a key position in the Manhattan Project.

George E. Richardson has been appointed Assistant to the Manager of the Feeder Division of Westinghouse Electric Corporation. The Feeder Division supplies castings, screw machine details, punchings, molded plastics, electroplated parts and copper products to the various Westinghouse operating divisions.

Among other duties, Mr. Richardson will have direct responsibility for the division's budget administration. He is a graduate in electrical engineering from Kansas State College in 1930 and a veteran of seventeen years with Westinghouse.

K. M. Anderson has been named technical Sales Representative for Zapon Product Finishes, according to a recent announcement by the Zapon Division of the Atlas Powder Company. Mr. Anderson has been in the industrial finishing field since 1937, except for two years with the 5th Amphibious Forces in New Guinea. He started with the Roaxalin Lacquer Company as a Sales Representative in New York City and Long Island. Then, following the war, he did free-lance work and advisory service to manufacturers in Connecticut and New York.

Horace H. Smith has undergone a serious operation in St. Barnabas Hospital, High Street, Newark, N. J. Mr. Smith is one of the most beloved and active members of the American Electroplaters' Society, of which he is a Past President and Honorary Member. He is the General Chairman of the Society's 1948 Convention and Industrial Finishing Exhibit. Our best wishes for his speedy recovery.

Edgar W. Harris, Director of Sales, Darco Corporation, was elected a member of the Board of Directors at a meeting of the Board in Wilmington, Del., January 28, 1948. Mr. Harris started with Darco in 1931. He will continue his headquarters in the company's General Sales offices in New York

Frank Savage has been elevated to Vice-President of the Standard Plating Rack Company, Chicago, Ill., according to announcement by Max Schneider, President.

Mr. Savage, who became connected with the company in August, 1947, came from the Kuehne Manufacturing Company, of Mattoon, Ill., where he served as Superintendent of the Metal Division. Previously, he was connected with C. G. Conn, Ltd. of Elkhart, Ind., in several capacities, the most recent being that of General Superintendent.

Mr. Savage is the author of several papers on electroplating, a Past President of the Chicago Branch of the American Electroplaters' Society and the immediate Past President of the Society. He is a graduate of the Chemical Engineering School of Michigan State College.

Bob Klaas, energetic Vice-President of Divine Brothers Company, is rapidly recovering from a broken leg received while horseback riding last Fall, his many friends will be glad to know. He is now up and around—leg braced, but it is slowing him up but slightly.

John E. Forster has joined the Zapon Division of the Atlas Powder Company as Supervisor of the Plant Service Group at the Stamford, Conn., plant.

Mr. Forster, during the war, was a captain in the Air Corps doing corrosion control work, and, until recently, with Valentine and Company in its lacquer plant. He is a graduate of Yale University, Class of 1937, and active member of the New York Paint and Varnish Club, and belongs to the Alpha Chi Sigma fraternity.

His duties will be the supervision of plant methods, control and salvage operations at Stamford.

G. V. Rittenhouse has been appointed its sales representative for industrial chemicals in the New York area, according to The Virginia Smelting Company, West Norfolk, Va.

Rittenhouse, a 1942 graduate in chemical engineering from Clarkson College of Technology, served three and a half years with the Army Engineers during the war and rose to rank of captain. Following his Army discharge, Rittenhouse was employed as a sales and technical serviceman in the St. Louis (Mo.) office of the General Chemical Company's Baker and Adamson Division. He joined Virginia Smelting last Spring.

Whether we supply plating tanks lined with GRS, Neoprene, or natural rubber, we use one rare extra ingredient: ***CARE!*** Extraordinary care. It is evident in every step of the job; in the preparation of the tank shell for the rubber-lining; in the careful application of cross-plied rubber sheets; in the precision control over every stage of the vulcanization process; and in the final inspection, so constantly rigorous that it prompted one new workman to mutter, "Hell, aren't you guys ever satisfied?"

Frankly, we never are, until we're absolutely sure that each "U. S." Paraply rubber-lined tank will do an even better job than our customer expects.

Of the hundreds of Paraply rubber-lined plating tanks we have installed during the last few years, just two have failed to measure up to this standard of service.

Can you ask for any better assurance of unqualified satisfaction?

OTHER "U. S." PRODUCTS FOR METAL FINISHERS

Tank Linings: Tygon-Resilon-Lead • Acid Brick and Tile • Chemical Stoneware Tanks, Pots, Jars • Tygon Corrosion-Resistant Plastic Paints • Tygon Tape • Tygon Rack Coatings • Tygon Stop-Offs and Masking Lacquers • Tygon Flexible Tubing • Ruscat Metal Cleaner • Lead Anodes • Dipping Baskets • Acid-Proof Floors.

Paraply Rubber-Lined Tanks are a Product of

U. S. STONEWARE
Akron 9, Ohio

Available through your local plating supply dealer, or write direct.

USE READER SERVICE CARD; INDICATE A 186.

Equipment & Supplies

E—27. New 36-Position Tap Switch on Selenium Rectifier Line.—A new series of selenium rectifiers with 36-position tap switch controls has been announced by Richardson-Allen Corporation, 15 W. 20th Street, New York, N. Y., as an addition to its line. These tap switches, although they do not offer the perfect accuracy in settings possible with the Step-less Variable Controls also featured by Richardson-Allen, do offer a very definite economy in purchase price.

Standard units are designed with 36-position voltage taps (6 coarse, 6 fine) with two controls. Finer voltage steps for 60- or 100-tap positions are available to meet special requirements. These units include voltmeter, ammeter with shunt, 5000-hour pilot light, start and stop push buttons, and are standard up to 27 kw capacity. Special units are available for higher kw requirements. For further information, use Reader Service Card.

E—28. New Protective Film.—Peelcote, a new protective coating for metal parts which can be easily and quickly peeled off after it has served its purpose, has been developed by the Watson-Standard Company, 225 Galveston Avenue, Pittsburgh, Pa. It is designed to protect from scratches, chipping and corrosion during shipment, storage, handling, and some types of fabrication. It can be applied by spray or dip methods and air-dries quickly.

Peelcote is a vinyl-base material of complete chemical inertness, available in clear transparent or solid hiding black. For further information, use Reader Service Card.

E—29. New Odorless Liquid Inhibitor for Sulfuric and Hydrochloric Acids.—Enthone, Inc., 442 Elm Street, New Haven, Conn., Dept. MR, has announced the development of Enthone Inhibitor No. 9, said to be of particular value where exhaust ventilation is not available. In solutions of either hydrochloric and sulfuric acids, the inhibiting action is over 90 per cent and in some cases up to 98 per cent.

The inhibitor dissolves cleanly in the acid solution leaving no sludge or residue. Acid solutions, therefore, are said to be easily rinsed off the work. The inhibitor is suitable for use in both cold and hot pickles. Steel coated with scale, oxide, or rust can be pickled quickly without attack upon the base metal. Therefore, bright surfaces are left bright after pickling operations, the result being an improved product when simple pickling is done or a better base for plating or hot coating, it is claimed. For literature and samples, use Reader Service Card.

E—30. Dust Control Unit.—The self-contained Dust Control Unit manufactured by Kirk & Blum Manufacturing Company, 2888 Spring Grove Avenue, Cincinnati 25, Ohio, is unusually versatile: it can be set up anywhere to serve any machine for as brief or as long a time as needed, will handle grinding, buffing, and polishing dirt and all similar dusts. Its principal features include an air volume of 900 cfm at 2-inch suction, capacity for four 3-inch, two 4-inch, or one 6-inch pipe connections, and a 4 cubic foot storage compartment. It is cleaned semi-automatically.

The unit is said to be highly satisfactory for handling dust problems in plants having isolated departments or for machines where the central station type of system is not applicable or practical. For further information, use Reader Service Card.

E—31. Saran-Lined Pipe and Fittings.—Saran-lined corrosion resistant pipe and fittings for conveying corrosive liquids combine the desirable features of steel pipe with extreme resistance to chemicals. Of particular use in metal plating, the pipe is resistant to a wide range of chemicals, oils, and solvents. It will satisfactorily carry sulfuric, hydrochloric, nitric, and phosphoric acids. Working temperature of the pipe ranges from 0 to 190° F.

Pipe in maximum lengths of 10 feet and in sizes from 1 inch to 4 inches will be produced by Dow Chemical Company, Midland, Mich. Fittings include elbows and tees, companion and reducing flanges, and gaskets. Conventional tools may be used for cutting and threading, and assembly of joints is similar to that of standard steel piping. For further information, use Reader Service Card.

E—32. Cleaning Fluid for Paint Spray Booths.—A quick way to eliminate all the commonly accepted difficulties of protecting the interior of paint spray booths is offered in "Booth-Coat No. 19" manufactured by Maas & Waldstein Company, 438 Riverside Avenue, Newark 4, N. J. It is a creamy compound which is non-inflammable, non-oily, non-caustic, and non-corrosive and can be applied by spray (water-thinned), brush, or trowel. When booth cleaning is indicated, a putty knife or similar scraping tool strips it freely from walls in continuous sheets leaving a clean surface beneath. For further information, use Reader Service Card.

E—33. Air Exhauster for Plating Shops.—The Jenn Exhauster manufactured by Jenn Air Products Company, 325-M Bankers Trust Building, Indianapolis, Ind., has unusual features which are said to be advantageous where air being expelled is laden with moisture, dust, etc. The motor is mounted out of the air stream, is directly connected to a self-cleaning centrifugal impeller, and can not become overloaded regardless of the length of duct used. It is constructed of aluminum and is designed for mounting on the outside wall with its louvered inlet extending through and connecting directly to the duct system.

Said to be ideally suited for use in plating and metal polishing shops, spray rooms and laboratories, its capacity is 980 cfm at 0 inch SP, 895 cfm at ¼ inch SP. The motor is a ¼ hp, 110 volt, 60 cycle, a-c, 1750 rpm unit; impeller is cast aluminum, single 8-inch inlet, centrifugal type, measuring 9 x 3 inches. Weight is 45 pounds. For further information, use Reader Service Card.

E—34. Infra-red Rack-Tub Bakes Plating Rack Coatings—Recent developments in plastic resins have remarkably simplified stop-off operations for rack coatings, and a new process involving the use of a Rack-Tub manufactured by Miskella Infra-Red Company, E. 73rd and Grand Avenue, Cleveland 4, Ohio, for the preheating and final baking essential to proper processing is claimed to offer definite advantages. The plater may now simply and quickly process racks in his own department.

The Rack-Tub is portable, comes ready to plug into a single phase, 230-volt line, and can handle a total load of 8 kw or 35 amp. It has two heat zones, each controlled by a 30-amp fused switch so that the lower half may be cut off when processing shorter racks. There are 16 toggle switches for further controlling the 32 fixed-focus 250-watt lamps. Floor space required is 1 square yard; height, 48 inches; weight, 200 pounds.

E—35. Flow Meter Testing Kit—Fischer & Porter Company, Hatboro, Pa., Dept. 4V-J, has just announced a new Laboratory Kit (rotameter type) designed to fill the need for a versatile and inexpensive flow measurement "set", to meet the varied flow measurement requirement of the research laboratory. It consists of a metering tube holder with base plate and hose connectors, four readily interchangeable tubes and six metering floats complete with calibration data. Capacities from 0.065 to 2200 cc/min of water and 5.0 to 36,800 cc/min of air are covered. For further information, use Reader Service Card.

E—36. Drum and Barrel Tilt—A new drum and barrel tilt has been announced by Palmer-Shile Company, 16004 Fullerton Avenue, Detroit 27, Mich. Designed to simplify materials handling and completely eliminate hand dumping, this new device is a proven timesaver for any industrial plant. Said to be excellent for controlled dumping of chemicals, liquids, plastics, and other materials. Equipped with two safety locking devices that hold

barrel securely without slippage, the barrel can be turned 360° by a turning mechanism that incorporates the worm drive principle and is available in chain models if desired. For further information, use Reader Service Card.

E—37. **Troxide Pickling Salt.**—An acid salt, inert until dissolved in water, Troxide is said to make for safety and ease in handling and to eliminate the need of liquid acids and the hazards that accompany their mixing; in operation, it reduces acid fumes and eliminates acid spray. According to the manufacturer, Waverly Petroleum Products Company, Philadelphia 6, Pa., regular Troxide will descale ferrous alloys without attack on the base metal; Troxide-E will descale and etch the metal at rates easily controlled by the operator. In pickling nonferrous alloys, Troxide-E will remove metallic oxides without attacking base metal, but can be combined with other compounds for bright dipping of metals. Neither form of Troxide will engender hydrogen embrittlement.

No special equipment is needed when substituting Troxide for liquid acids in the pickling cycles. For detailed information on Troxide and its applications, and for instructions and samples of the compound, use Reader Service Card.

E—38. **New Black on Zinc.** The Mitchell-Bradford Chemical Company, 2446 Main Street, Stratford, Conn., announces the development of a new Black Magic Zinc Black process for zinc plate, zinc alloy die castings, and cadmium plate. The finish is applied by immersion in the solution, resulting in a chemical reaction with the zinc or cadmium surface to produce a glossy black finish. A very short immersion time is required, from one to two minutes for zinc and zinc alloys and three to five minutes for cadmium plate.

The resultant finish is said to have (1) high abrasion resistance, being used on moving parts and parts subject to constant abrasion and pressure; (2) excellent resistance to most alkalis, acids, and organic solvents; (3) eye appeal, being used on zinc die cast toys, machine parts, recorders, camera parts, etc.; (4) tenacious bond for subsequent application of paints and enamels, 30 seconds in the solution having provided a satisfactory paint bond. A plain steel tank is used for the processing tank.

Finished samples and further information are available upon request. Use Reader Service Card.

E—39. **New Anti-Corrosive Coatings.**—Two new types of anti-corrosive Zincilate coatings which will air-dry without baking, have been announced by Industrial Metal Protectives, Inc., Dayton 2, Ohio.

The coatings are sufficiently flexible that sheets, pipes and forms can be bent double after coating without breakage of the coating. Overcoatings of enamel, paint or wrinkle finishes may be applied over Zincilate after five minutes of air drying, and both coatings baked at the same time. Zincilate is adaptable to production line application by dipping, spraying, brushing, or roller coating, with conventional finishing equipment. For further information, use Reader Service Card.

E—40. **Porcelain Enamel Tester.**—The adhesion of porcelain enamel to base metal can be measured by magnetic means with a new tester developed by the Research Foundation of the Porcelain Enamel Institute in the National Bureau of Standards.

The new instrument was designed primarily to supplement the conventional fracture test and to provide more complete data on the impact characteristics of porcelain enamels.

E—41. **Drum Carrier**—The Drum-Karrier, as the trade name is known, is a rugged low-cost tool manufactured by The Folstrom Company, Folstrom Court, Passaic, N. J., which is said to make an efficient drum handling system out of any monorail hoist, crane or chain fall. Initial installations in chemical, metal working, paint and varnish as well as other plants, have proved highly successful in speeding drum movements, resulting in time and labor savings. The new drum accessory features one-man operation and fits all standard size drums. The drum carrier is simply hooked in position, cinched around the drum and transported where needed. Positive tilt locks hold drum in vertical position and permits easy controlled tilting to mix or dispense contents over receiving tank. Designed and built for long hard service with heavy duty, all-steel construction is claimed to assure lasting service at top production level. For further information, use Reader Service Card.

E—42. **New Paint Scraper**—Said to remove all kinds of paint, varnish, lacquer, and enamel from both flat and curved sheet metal surfaces many times faster than conventional scrapers, a paint scraper of radically new design has been perfected by Carboloy Company, Inc., of Detroit, Mich., and is being manufactured and distributed nationally through retail hardware and paint stores by Red Devil Tools, Irvington, N. J., well-known manufacturers of the Red Devil line of hand tools and machinery.

The new Red Devil scraper has a specially designed blade of the Carboloy cemented carbide. The blade can be set in the holder so as to protrude varying amounts to right or left. It can also be adjusted so as to utilize any of its four specially shaped corners. For further information, use Reader Service Card.

For Sale

Slightly Used BUFFS

LOOSE AND SEWED

ANY QUANTITY

ALL SIZES

MICHIGAN BUFF CO., INC.

3503 GAYLORD AVENUE DETROIT 12, MICHIGAN

CUT METAL CLEANING COSTS 50%

DIVERSEY NO. 909*

AMAZING NEW HEAVY DUTY SOAK TANK CLEANER ELIMINATES ONE OR MORE PRE-CLEANING OPERATIONS!

Yes, actual case histories reveal that new Diversey No. 909 often eliminates solvent pre-soak and hand-wipe operations . . . cuts metal cleaning costs as much as 50%! In addition, Diversey No. 909 solutions outlast ordinary cleaners 2 to 1 . . . more than pays for itself in just a short time!

Check the many outstanding features of this unique, non-caustic yet powerful approach to greater metal cleaning efficiency . . . greater savings! Diversey No. 909 is specially designed for heavy duty soak tank cleaning of iron, steel, copper, brass, magnesium and zinc alloys.

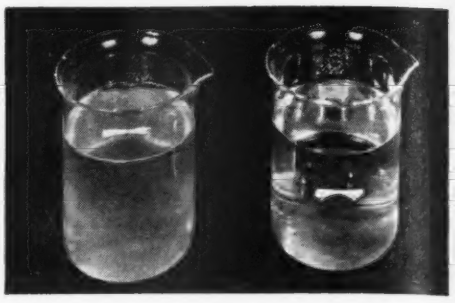
*Formerly Diversey No. 99.

TEN OUTSTANDING ADVANTAGES!

1. **Possesses instantaneous wetting action with complete penetration of foreign matter.**
2. **Rapid and complete dispersion of solid dirt particles.**
3. **Free of caustic soda.**
4. **Superior water softening power ties up major portion of hardness into soluble complex forms so it cannot precipitate.**
5. **Solutions rapidly emulsify mineral oil, grease, waxes, tallows, sulfurized and chlorinated oils, fats, fatty acids and compounded oils and mixtures.**
6. **Strong peptizing power.**
7. **Complete free rinsing action.**
8. **Completely soluble and 100% active.**
9. **A white, free-flowing granular product, with light tan tint. Practically dustless . . . will not give off fumes, is odorless and easy on the hands.**
10. **Economical to use.**

CLEAN FASTER!

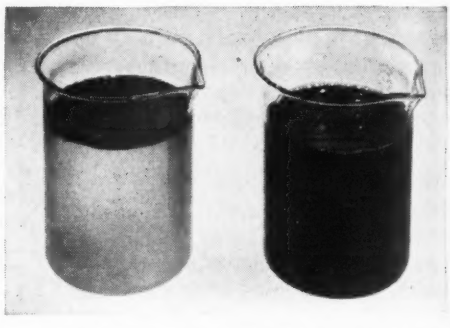
DIVERSEY NO. 909 ASSURES INSTANTANEOUS WETTING POWER!



Proof! Chemically treated strings are dropped into solutions of Diversey No. 909 and ordinary cleaner. The chemical indicator reacts when string is completely wetted. In the Diversey No. 909 solution the reaction is instantaneous . . . string changes immediately from white to pink. Also, the string in Diversey No. 909 solution sinks to bottom of beaker faster. This superior wetting power of Diversey No. 909 is the reason it gets started first . . . cleans faster regardless of how tough the job may be!

CLEAN THOROUGHLY!

DIVERSEY NO. 909 PROVIDES POWERFUL DIRT DISPERSION ACTION!



Proof! Several drops of synthetic dirt are added to equa amounts of Diversey No. 909 and ordinary cleaner solutions. In the Diversey No. 909 beaker, the dirt is rapidly broken up and completely dispersed throughout the solution. However, with the ordinary cleaner, the drops stick together and do not emulsify. When the two beakers are drained, the superiority of Diversey No. 909 really shows up! Here, the beaker surface is left absolutely clean. In the ordinary cleaner beaker, dirt is left clinging to its sides.

CLEAN SAFELY!

DIVERSEY NO. 909 IS NON CAUSTIC!

Proof! A small amount of Diversey No. 909 is placed on the palm of the hand. Water is added. No burning . . . no stinging sensation is felt . . . no chance of dangerous skin irritations and other complications often caused by caustic cleaners. No, Diversey No. 909 is absolutely safe . . . makes heavy duty soak tank cleaning more pleasant for workers.

Write today for complete information

DIVERSEY

Complete Surface Preparation Service

FOR THE METAL INDUSTRIES

THERE'S A DIVERSEY D-MAN AND A DIVERSEY PRODUCT BETTER ABLE TO SERVE YOU IN ALL METAL PREPARATION PROCEDURES

TRY DIVERSEY . . .

No. 12 . . . for anodic electro cleaning
No. 16 . . . emulsion cleaner for spray washing machine
No. 36 . . . perfected aluminum cleaner
EVERITE . . . for removing heat scale and rust
No. 511 . . . non-etching anodize stripper

THE DIVERSEY CORPORATION

Metal Industry Department

53 W. JACKSON BLVD., CHICAGO 4, ILL.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 188.

New Literature

L—15. **Industrial Air Compressors**—A single-page leaflet (Form E-219) descriptive of the new "Air Chief" line of industrial compressors manufactured by Davey Compressor Company, Kent, Ohio, contains mechanical data and specifications on complete departmental units of 60, 105, 160, 210, and 315 cfm capacities and lists bare compressors suitable for installation with customers' motors or as replacement machines. Advantages of the "departmental" compressor system are detailed. For your copy, use Reader Service Card.

L—16. **High Nickel Alloys**—"Nichrome," "Chromax," "Advance," and a number of other high nickel electrical heat and corrosion resisting alloys are described in a new 72-page catalog (R-46) published by Driver-Harris Company, 2nd and Middlesex Streets, Harrison, N. J. The subject matter for the most part is presented in easy-to-read tables and charts and includes specifications, data on applications, life expectancy, current-temperature characteristics, etc. Weights and prices are listed in numerous instances. For your copy, use Reader Service Card.

L—17. **Liquid and Gas Flow Measurement**—A 32-page profusely illustrated catalog section 10-D describes the numerous advantages of the "Flowrator" meter for flow rate measurement, manufactured by Fischer and Porter Company, Hatboro, Pa. Among important topics are: basic principles, flexibility, accuracy, linear flow characteristics, flow range, immunity of calibration to viscosity variations, etc. For your copy, use Reader Service Card.

L—18. **Dust and Fume Eliminator**—A 12-page folder describes and illustrates the "Centri-Merge" swirl type dust and fume eliminator for diverse applications from foundry sand handling to grinding and buffing. Operating and construction features are elucidated by text, drawings, and blueprint diagrams. The manufacturer is Schmieg Industries, Inc., 382 Piquette Avenue, Detroit 2, Mich. For your copy, use Reader Service Card.

L—19. **New Bristol Catalog in French**—A new general catalog entitled, "Specification Index for Bristol Instruments," has just been published in the French language by the Bristol Company, Waterbury 91, Conn. The catalog, No. W1815, contains twenty-four pages of information on the Bristol line of automatic controlling, recording, and indicating instruments for use in industry and gives hints on how they can be used effectively to save time and money and promote efficient operation in manufacturing processes. Specification data is given for each instrument listed. The booklet is liberally illustrated with line drawings which show basic methods of applying various types of industrial instruments. For your copy, use Reader Service Card.

L—20. **Axiflo Fans**—An 8-page color booklet (B-3804) describing the economic and versatile performance of the new line of Westinghouse Axiflo fans has been released by the Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

Especially significant in the design is the low resistance cone housing that keeps the motor, belts, and all bearings out of the air stream, thereby making possible a great variety of high-temperature applications. Complete with pictures of available models in either the elbow or straight-through type, the booklet describes how these positive pressure fans are applied in air-conditioning systems, heating and ventilating, dust and fume removal, equipment and machinery cooling, heat treating non-ferrous metals, and industrial drying and processing.

Axiflo fans are available with either three-bladed aluminum alloy or eight-bladed welded steel fan wheels. Characteristics and special advantages of each are listed. For your copy, use Reader Service Card.

ANNOUNCING

Divine

BELTFLEX

CONTACT WHEELS

Give positive polishing action on light contour and radius work where resilient action is necessary.

FLEXIBLE—They mold the belt to the work surely and effectively.

BALANCED—for smooth running, and to give constantly accurate pressure to the working surface. A smoothly ground face assures uniformity.

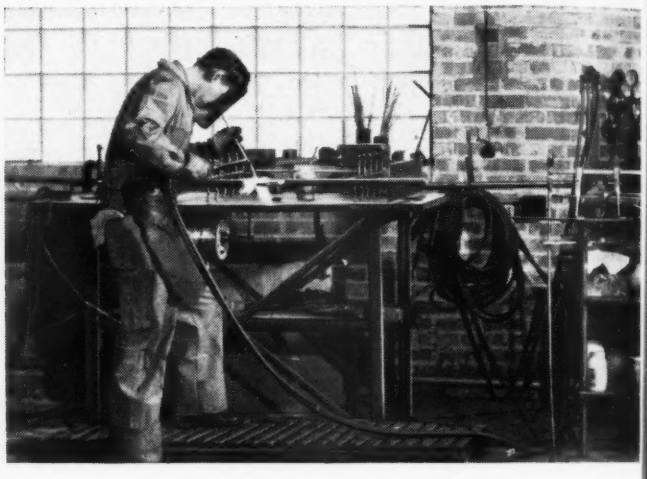
TWO DEGREES OF DENSITY—one offering greater flexibility, the other more aggressive cutting action . . . both giving pliability and resilience beyond standard contact wheels.

WIDE SIZE RANGE—face widths and diameters for most requirements. Wheel equipped with metal hub. Generally most effective when used with Jeans Cloth (J weight) belts.

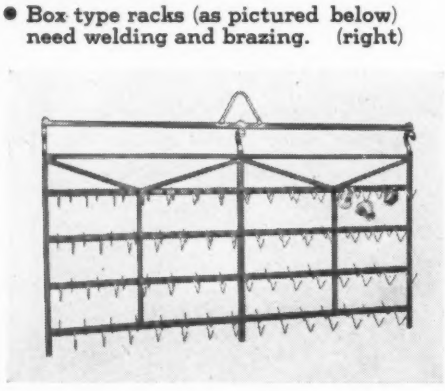
Divine Brothers Company

UTICA 1, N.Y., U.S.A.

Plating Problems make better racks



- Fast, accurate punch presses—widely used in the manufacture of Standard racks. (top right)
- Automatic screw machines speed production. (left)
- Box type racks (as pictured below) need welding and brazing. (right)



Your plating problem is Standard's business. In the past 12 years, we've designed thousands of racks for a multitude of problems. As a result, our research department is able to invent new features . . . design better racks for electroplaters.

When Standard receives your specifications, experienced engineers work out a design that will accommodate your part efficiently at low cost. After your approval of a sample, the rack goes into mass production.

This procedure has led to the important development of Stand-It-All Insulation. Permanently bonded to the rack, this flexible insulation prevents plating up of the rack—saves material and current costs Stand-It-All will not contaminate the plating solution, gives the rack long life.

Make Standard your measure of quality. You'll find Standard Plating Racks the answer to your most intricate problem.

STANDARD

PLATING RACK COMPANY

"What's in a name?"

1912–1925 NORTH PAULINA STREET, CHICAGO 22, ILLINOIS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 190.

L—21. Finish Selector Guide—A so-called Novelty Finishes Color Deck contains 27 different 3 x 5 inch color chips and shows a variety of lacquers, enamels and synthetics. It is of particular interest to industrial designers, design engineers, stylists, and others whose job it is to pick the right finish for a product. It is available upon written request on company stationery to Maas and Waldstein Company, 438 Riverside Avenue, Newark, N. J., producers of lacquers, enamels and synthetics.

L—22. Pre-painting Treatments—A 4-page folder describing the applications of Deoxidine Nos. 126 and 624 and Lithoform has just been made available by American Chemical Paint Company, Ambler, Pa. For your copy, use Reader Service Card.

L—23. Laboratory Directory—A complete listing of commercial and university testing and research laboratories throughout U. S. A., together with indications of the type of commodities tested, has been compiled by the National Bureau of Standards. A total of 220 commercial laboratories with 80 branches or offices and 189 college laboratories used for testing as well as instruction is included.

The listing is entitled "Directory of Commercial and College Laboratories" and is available from the Superintendent of Documents, Washington 25, D. C., at 25 cents per copy. It is designated as N. B. S. Miscellaneous Publication M187.

L—24. Tank Ventilation—A new 36-page bulletin entitled, "Design Data for Lateral Tank Ventilation", has been published by De Bothezat Fans Division, American Machine and Metals, Inc., East Moline, Ill. Following a discussion of important factors in fume control are line drawings of applications of exhaust equipment, tables, formulas, and numerous illustrative examples of detailed calculations. A number of graphs for the simplification of the calculations complete the bulletin. For your copy, use Reader Service Card.

L—25. Steam Equipment—A special bulletin featuring pressure regulators, temperature regulators, self cleaning strainers and steam traps manufactured by The O. C. Keckley Company, 400 W. Madison Street, Chicago 6, Ill., is now available. It includes dimensions, applications, capacity and engineering tables along with specifications. For your copy, use Reader Service Card.

L—26. Tumbling Barrels—Four new two-page bulletins have been issued by Lupomatic Industries, Inc., 4510 Bullard Avenue, New York 66, which illustrates and describes tumbling barrels of several types for cutting down, deburring, burnishing and polishing metal and plastic parts. The types are (1) Dry process single tumbler barrels; (2) Multiple unit barrels for wet or dry process, heavy production work; (3) Wet process, single and multiple units; (4) Wet ball burnishing machines for burnishing and polishing jewelry and small metal parts. These bulletins also describe and give general recommendations for the compounds to be used for ordinary wet or dry tumbling processes.

A separate bulletin has been issued which gives complete processes and suggestions for proper compounds and carriers to be used under certain conditions of finishing work on metal and plastic parts.

A copy of any one or all five bulletins will be sent on request. Use Reader Service Card.

L—26. Belt Conveyor—Island Equipment Corporation, 101 Park Avenue, New York 17, N. Y., offers a Bulletin IP-1 which describes the "Island Unitized Table" which replaces the "Unitable", no longer manufactured by the company. Built with rigidly standardized parts for interchangeability, the unit can be used for assembly, inspection and conveying, as well as a work table. For your copy, use Reader Service Card.

L—27. Variable-Speed Buffing and Polishing Lathe—Divine Brothers Company, Utica 1, N. Y., manufacturers of buffing and polishing wheels, machinery and supplies, has recently issued a new bulletin and price list VGSV-1 which describes a new, improved "Flexspeed" variable-speed lathe for buffing and polishing.

CHROMIUM CHEMICALS

FOR THE ELECTROPLATER

MUTUAL CHEMICAL CO. NEW YORK

OVER A CENTURY OF CHROMIUM CHEMICAL PROGRESS

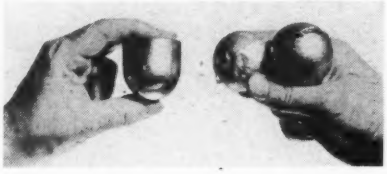
- CHROMIC ACID
- BICHROMATE OF SODA
- BICHROMATE OF POTASH

MUTUAL CHEMICAL COMPANY OF AMERICA

270 MADISON AVENUE NEW YORK 16, N.Y.

The new machine is available in 3, 5, and 7½ h.p. sizes. It features a simple handwheel adjustment for changing the spindle speed through a range of 1800 to 3500 rpm. The operating speed is easily read from a speed indicator mounted on the top front of the lathe. As a consequence, the user is able to use the correct and most economical wheel speed—even on wheels which have been worn down from their original diameter. For your copy, use Reader Service Card.

L—28. New Zinc Anode—A new form of zinc anode, destined to solve some of the common problems in electroplating, introduced and now manufactured by Wagner Brothers, Inc., Dept. K, 425 Midland Avenue, Detroit 3, Mich., is described in a 4-page folder. Known by the copyrighted name of "Flat Top" because of its shape, the anode is so distinctive in appearance as to prevent accidental confusion with cadmium or tin ball anodes, thus avoiding mixing of plating solutions and the consequent loss of time and materials from shut-downs and dumping of plating tanks.



The Flat Top shape is retained throughout the plating process, so that a glance at the anode basket will identify the zinc tank. The anode's smooth surface is free from gates and flash which frequently cause ball anodes to hang on the basket wires, and the effective plating area is from 20 to 25 per cent greater than that of a ball of like diameter. The greater weight per anode reduces loading frequency. According to the manufacturer, the zinc is 99.99 per cent pure, the highest purity available.

Another Flat Top innovation is the new wooden keg container which is sealed against contamination. The standard package is 250 pounds. Price structure is the same as for ball anodes. For your copy, use Reader Service Card.

L—29. Semi-Automatic Plating Conveyors—Belke Manufacturing Company, 947 N. Cicero Avenue, Chicago 51, Ill., offers a new 4-page bulletin, "Variable Speed Semi-Automatic Plating Conveyors", which describes the units in detail. It also describes how they increase plating production, produce high quality plating, save labor and reduce plating costs. For your copy, use Reader Service Card.

L—30. Cleaning Factors in Burnishing—A thorough-going discussion of the cleaning factors involved in burnishing operations is presented in an illustrated feature article appearing in a recent issue of "Oakite News Service," house organ of Oakite Products, Inc., 157 Thames St., New York 6, N. Y.

Before burnishing, all surface soils such as greases, stains, rust and oxides must be thoroughly removed and proper facilities should be maintained for this task. An installation incorporating a cleaning tank or barrel, a bright dip or pickling tank, and suitable rinsing arrangements is recommended. After pre-cleaning, a careful check should be made to make sure that the burnishing barrel is scrupulously clean and that the balls and shapes are free from dirt and rust. Next, in the critically important selection of the burnishing solution itself, the article suggests that the following considerations be weighed: (1) Does solution have the ability to prevent abrasion and metal-to-metal contact of the work? (2) Is it capable of removing and suspending dirt left by imperfect precleaning? (3) Does it offer sufficient lubrication to cushion the action of the pieces as they move in contact with one another? (4) Is solution so compounded that it will not form insoluble, sticky hard water soaps?

In conclusion, this article provides an interesting description of actual cleaning and burnishing procedures employed in a plant manufacturing aluminum mallet-type meat tenderizers. Specific details of materials, solution concentrations and temperatures, etc., are given in full. Readers desiring free copies of the issue of "Oakite News Service" in which this informative article appears, should use Reader Service Card.

Filter All Plating Solutions Faster, More Completely in

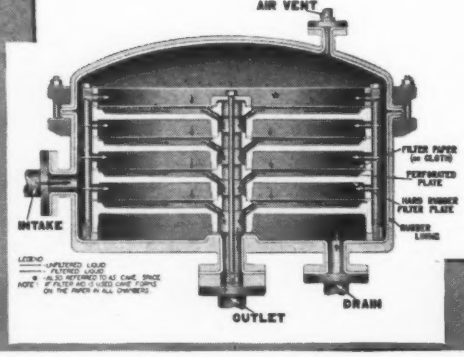
SPARKLER
Horizontal Plate
FILTERS

Because the filter cake is held horizontally, it is absolutely stable to the end of each filtering cycle. And cycles are longer because the cake retains its porosity longer. That is why the "horizontal principle," as embodied in Sparkler filters, gives you more efficient, low cost, operation. Sparkler filters are pressure-tight and leak-proof, designed for intermittent or continuous operation.

4 Plating Solution Types

1. Rubber-lined for bright nickel
2. Stainless steel for acids
3. All Iron for alkaline solutions
4. All Steel (with Stainless Pump) for chromium

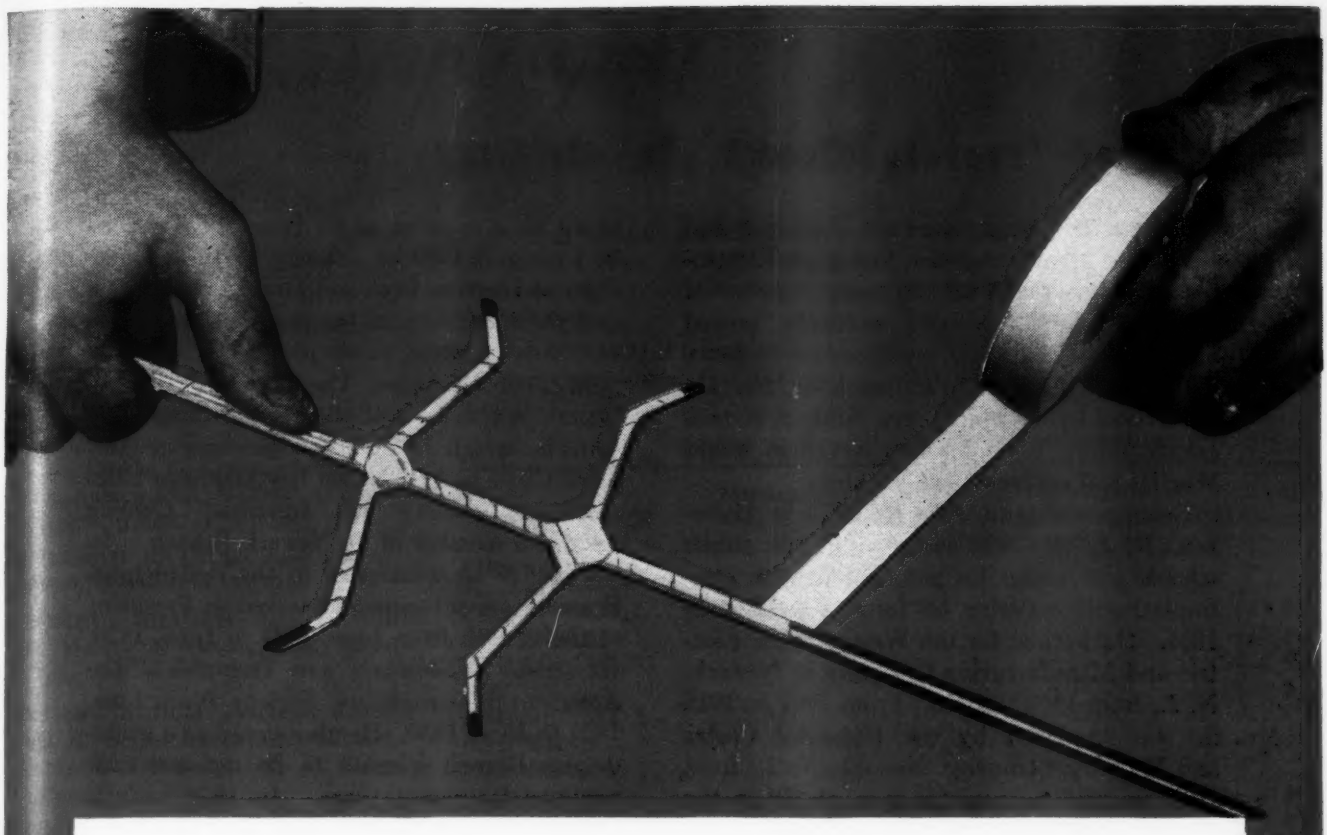
SPARKLER MANUFACTURING CO.
Mundelein, Illinois



Made in Capacities
60 to 10,000 G.P.H.

See your supplier or Write for details

Our Engineering Service is available for any specialized problems.



This new ELECTROPLATING TOOL saves time . . . does a SUPERIOR JOB:

"SCOTCH" TAPE No. 471—Yellow—brings new facility and speed to the masking of articles to be electroplated, also to the protective wrapping of electroplating racks. Its thin caliper, close adhesion, and resistance to plating solutions insure clean edges to plated areas.

Cracks or breaks in rack insulation are quickly and effectively sealed with this new "SCOTCH" Tape. High stretch enables it to conform easily to any surface. Very economical—only one thickness is necessary for complete insulation against plating solutions.

Write today for a sample and further information. Ask for "SCOTCH" Tape No. 471—Yellow.

REG. U.S. PAT. OFF.

SCOTCH BRAND TAPE No. 471 Yellow

FOR ELECTROPLATING

ANOTHER 3M COMPANY PRODUCT

Made in U.S.A. by **MINNESOTA MINING & MFG. CO.** St. Paul 6, Minn.

✝

George H. Gehling

GEORGE H. GEHLING, Past President and Honorary Member of the American Electroplaters' Society and an Honorary Member of its Philadelphia Branch, suddenly passed away in his 74th year on Monday, January 26, 1948, at his home in Philadelphia, Pa. He is survived by his widow, five children, sixteen grandchildren, four of whom served in World War II, and six great-grandchildren.

Gehling was born July 16, 1873 in Hoboken, N. J. He was educated in the public schools and began his association with electroplating by entering his father's business in 1886. He worked for the Westinghouse Electric and Manufacturing Company in Newark, N. J., from 1900 to 1906. From 1907 to 1916 he was employed by the Universal Caster and Foundry Company, Newark, N. J.; from 1916 to 1917 he was foreman plater at the Miller Lock Company, Philadelphia, Pa., from 1917 to 1918 at the Penn Rivet Company, Philadelphia, Pa.; from 1918 to 1935 at the DeLong Hook and Eye Company, Philadelphia, Pa. He was the Philadelphia representative of the Frederick Gumm Chemical Company, Kearny, N. J., from 1935 until one-half year before his death, when he retired on a pension.

In his early days he was very active in Union No. 44. He served six terms as delegate to the Essex Trade Union Council, two terms as a member of its Board of Trustees, in 1898 and 1899 as delegate to the conventions in Dayton, Ohio and Orange, N. J., several years as financial secretary of the union and, subsequently, as its president.

In 1910 he joined The National Electroplaters' Association of the United States and Canada, which had its headquarters in New York City. In 1913, when the American Electroplaters' Society was organized, Gehling became a member of its Newark Branch. In May, 1917 he transferred to the Philadelphia Branch. He subsequently served as President of the Branch from June, 1921 to June, 1929. He served as Secretary and Treasurer of the American Electroplaters' Society from June, 1925 to June, 1930. He also served as a Philadelphia Branch delegate to its national conventions for many years. In 1930 he was elected A. E. S. President and in 1941, at the Boston Annual Meeting, he became an Honorary Member of the Society.

Few members have been identified with the Society for a longer period, and none have worked more energetically and enthusiastically for its advancement. Truly an "old timer," his labors shall be missed and his passing shall be mourned by all the members.

A delegation of Philadelphia Branch members and representatives from the A. E. S. National Office paid him final tribute.

Thomas J. Brosnan

THOMAS J. BROSNAN, Honorary Member of the American Electroplaters' Society and of its New Haven Branch, died on December 3, 1947. His funeral at the Holy Trinity Church and burial in St. John's Cemetery on December 6 was attended by many members of the Society.

Brosnan was a very capable old-time plater who had spent almost all his working days in the silverware industry. Following many years, 1876(?)–1907, with Simpson-Hall Miller Company, now Factory L of International Silver Company, Wallingford, Conn., he worked for National Casket Company, Pittsburgh, Pa., for two years and for E. H. Smith Silver Company, Bridgeport, Conn., for eight years, before he joined the Wallingford Company, now the Hollow-ware Division of R. Wallace & Sons, in 1918. In 1938 he went on sick leave but except for a few months of advisory work, was unable to return and had to retire.

His survirors, wife, three daughters and two sons, several grandchildren and one great-grandchild, and his many friends in the industry mourn his passing.

Membership Report

of the American Electroplaters' Society

Elections

CHICAGO BRANCH: Emmett H. Babcock, James H. Bacha, Harry J. Clohecy, Russell W. Cuthbert, John E. Epert, William B. Johnson, Samuel A. Maita, Carl G. Westergaard

CINCINNATI BRANCH: J. Robert Adams, Carlton C. Clabaugh, Earl D. Creese, Charles C. Curtin, Malcolm T. Fogg, Aubrey Holt, Willis P. O'Brien, George F. Willett, Jr.

CLEVELAND BRANCH: Joseph Demyanchik, Kenneth W. McCrea

COLUMBUS BRANCH: John G. Benson, Harvey E. Orwick, Basil Wood Waring

DAYTON BRANCH: Frederick Bauch, Paul E. Geske, Lawrence J. Hibbert, Warren E. Robinson, Dale D. Suter, Gustave D. Wendt

DETROIT BRANCH: William L. Brittain, George R. Canary, George A. Cantrick, Richard E. Collins, Chester O. Jones, Rudolph J. Kuretich, Leland J. Ward, Robert M. Waters, Marvin O. Wirth, Emanuel H. Murray

LANCASTER BRANCH: William F. Allen, William C. Bauer, Harry A. Saylor

LOS ANGELES BRANCH: Glen R. Moler, Jr., Frederick J. Raymond, Jr., George W. Slomin

MILWAUKEE BRANCH: Edmund F. Dawicki, James F. Hamilton, Donald R. Mittelstaedt, Ralph Wenzel

MONTREAL BRANCH: Jeffrey G. Carrique, Morton Levitt, Georges Morrisette

NEW YORK BRANCH: Herbert S. Brooker, Albert Gould, Robert N. Lee, Howard J. Mosier, Peter Stevens, Jack Topfer

PHILADELPHIA BRANCH: William Paul Bricker, Edward J. Devlin, Harold Frohwitter, Laurence N. Thomas

PROVIDENCE-ATTLEBORO BRANCH: George Belcore, Albert E. Centofante, Clifford I. Healy

ROCHESTER BRANCH: George T. Bowles, Clarence Chichester, John M. Duford, Albert E. Drews, Charles B. Fideor, Harold F. Fulton, Gordon MacDonald, Frank Newton, Michael Pavone, Laurence W. Ridpath, Harlow Shepard, Daniel Taurielle, Walter F. Swanton, Anthony G. Valvane, William Whitbourne

ST. JOSEPH VALLEY BRANCH: Robert F. Aller, Charles E. Hill, John L. Humecke, David R. Johnson, John V. Schaefer

TOLEDO BRANCH: Kenneth Bitterman, Clifford Cunningham, Ben Gomersall, Gail H. Teinplin

TWIN CITY BRANCH: G. L. Hendrickson, Paul R. Hesse, Louis W. Zwick

WATERBURY BRANCH: Constantine L. Capobianco, Joseph A. Jurgenis, John E. Larkin

OTHERS: Harold Silman, Simon Wernick, Oscar Rey Varela

(*Continued on page 297*)

BRANCH	Membership May 1, 1947	New Members	Net Change in Membership	Per Cent Net Change
FIRST GROUP				
PITTSBURGH	126	24	+18½	+14.6
LOS ANGELES	195	35	+23½	+12.1
PHILADELPHIA	191	31	+18	+ 9.4
BOSTON	156	24	+14½	+ 9.3
BRIDGEPORT	147	17	+11½	+ 7.8
HARTFORD	140	11	+ 9	+ 6.4
TORONTO	136	13	+ 7½	+ 5.5
CLEVELAND	190	22	+ 8	+ 4.2
NEW YORK	257	23	+ 6	+ 2.3
GRAND RAPIDS	136	29	+ 2½	+ 1.8
DETROIT	418	51	− ½	− 0.1
CHICAGO	410	47	− 1½	− 0.4
NEWARK	253	22	− 1	− 0.4
SECOND GROUP				
ROCHESTER	87	20	+21	+24.1
ST. JOSEPH VALLEY	89	17	+ 8½	+ 9.5
TWIN CITY	89	9	+ 8	+ 9.0
ST. LOUIS	96	7	+ 6½	+ 6.8
SAN FRANCISCO	77	6	+ 3½	+ 4.5
WATERBURY	116	6	+ 3½	+ 3.0
MILWAUKEE	124	12	+ 3	+ 2.4
DAYTON	95	10	+ 2	+ 2.1
BALTIMORE-WASH.	117	11	+ 1	+ 0.8
NEW HAVEN	114	10	− ½	− 0.4
BUFFALO	98	9	− 1½	− 1.5
PROV.-ATTLEBORO.	126	22	− 2½	− 2.0
INDIANAPOLIS	103	23	− 3½	− 3.4
THIRD GROUP				
TOLEDO	55	26	+18	+32.8
ADELAIDE	49	14	+13	+26.5
CINCINNATI	52	15	+13	+25.0
LANCASTER	38	9	+ 6	+15.8
SYDNEY	78	17	+10½	+13.5
SPRINGFIELD	49	6	+ 5	+10.2
COLUMBUS	35	9	+ 3	+ 8.6
SYRACUSE	73	3	+ 1½	+ 2.1
MONTREAL	60	4	.....	.....
MELBOURNE	61	..	.....	.....
ROCKFORD	64	4	− 2	− 3.1
SOUTHEASTERN	43	4	− 1½	− 3.5
JACKSON-LANSING	65	4	−10	−15.4
OTHERS	78	10	.....	.....
TOTAL A. E. S.	4,886	636	+224	+4.6

Membership, February 10, 1948 5,110

YOU TIE UP

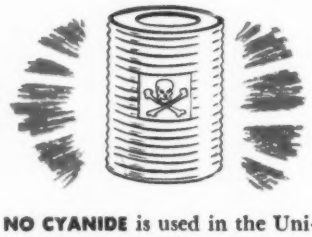
FEWER ANODES IN UNICHROME COPPER

. . . and make sure of 100% anode-efficiency, besides!

IT'S MONEY IN YOUR POCKET instead of copper in your tank when you plate with *Unichrome* Copper. For anodes always corrode evenly—even at high current densities. So you get 100% anode-efficiency—*with 50% to 75% fewer anodes!* And that adds up to plenty of poundage in most installations.

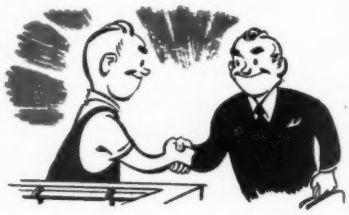
And this is only one of five important advantages you get from the mildly alkaline, all-purpose Unichrome process. Which is why we say: Compare it with any other process, and we believe you'll specify Unichrome Copper every time! *Write for helpful technical bulletin.*

BUFFING TIME IS CUT—often eliminated entirely—because Unichrome Copper gives you a *smoother* deposit. And because it's a *fast* process, you save time in the tank as well. Only when you save *both* ways do you really lower plating costs.



NO CYANIDE is used in the Unichrome Copper bath—so you not only reduce your stocks of this hazardous chemical, but get a safer bath as well.

CLEAN DEPOSITS never need activation. With no brighteners, no wetting agents used, Unichrome deposits come out clean, ready for the nickel cycle without special treatment.



HELPFUL SERVICE—Unichrome Copper is simple to maintain, seldom gives trouble. But should the need arise, you can always count on prompt help from our engineers and analytical laboratories.

UNICHROME

PROCESSES AND MATERIALS

FOR SURFACES THAT SURVIVE

Chromium Plating • Porous Chromium • Unichrome* Copper
Unichrome Lacquers • Ucilon* Protective Coatings
Unichrome Stop-Off Lacquers and Compounds • Unichrome Dips
Unichrome Rack Coatings • Anozinc* Compounds • Unichrome Strip
*Trade Mark Reg. U. S. Pat. Off.

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FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 194.

Determination of Impurities

(Continued from page 263)

smoke contains relatively high concentrations of potassium and after exhalation will contain detectable quantities of sodium. Thus smoke which is drawn into the burner will tend to give false readings.

Summary

A method which makes use of the principles of flame photometry is described for the rapid and accurate determinations of sodium and potassium ions present as trace constituents in nickel plating baths. The bath sample is diluted to ten times its original volume. This diluted solution is atomized in the flame photometer, and the intensity of the characteristic light of either sodium or potassium is measured, the dial reading representing the relative brightness of the sample with respect to a standard. The concentration of the ion in the diluted sample is read off a calibration curve.

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Membership Report

(Continued from page 295)

Reinstatements

MILWAUKEE BRANCH: Paul R. Nesson

TOLEDO BRANCH: William W. Hunlock

OTHERS: Edward S. Richards

Transfers

Joseph R. Eisele from Bridgeport Branch; J. A. Gorz from Chicago Branch; Bernard Agruss from Columbus Branch; D. F. Seymour from Dayton Branch; C. C. Conley to Detroit Branch; Russell O. Kline to Detroit Branch; J. L. Post to Hartford Branch; E. J. Wright from Los Angeles Branch to Sydney Branch; Edw. B. Sanigar from Philadelphia Branch; Henry Grossenbach from New Haven Branch to Waterbury Branch

Suspensions

CHICAGO BRANCH: N. J. Bene, Chester F. Beyer, William A. Burke, H. Cohn, William J. Couch, Chester J. Crescio, Richard F. Gawron, C. Germaine, Stuart D. Goodwin, Jr., C. T. Grigsby, L. Glen Hakes, Conrad H. Hanley, Jr., C. F. Hansen, E. E. Hawkinson, Richard H. Hoogenberg, Walter R. Hosek, G. W. Howlett, Walter F. Jenski, F. Johnson, Fred H. Kletka, E. R. Kraft, John Kronsbein, Stanley B. Lee, Glenn E. Malohn, Ray F. Meydrech, George F. Meyer, Thomas A. Murphy, Frank Neul, D. W. Newman, S. F. O'Connor, Burton L. Price, W. C. Radunz, Jose G. Rojas, Richard J. Sanders, H. Schuppe, B. B. Se Breng, B. Sills, William O. Starnes, Raymond P. Wiedbusch, H. M. Writer, Louis G. Wurster, Meredith C. Zinn

CLEVELAND BRANCH: Fred J. Hill, William C. Jenkin, Anton L. Nielson, Frederick Roberts, Joseph Saletel, Isaac Tiktin

LOS ANGELES BRANCH: Max Goldman, John Mayer, John Mann, Frank Denman

MILWAUKEE BRANCH: Leonard Beck, Robert E. Boettcher

SYDNEY BRANCH: R. F. Haren

TOLEDO BRANCH: Howard Hilfinger

OTHERS: Raymond de Buyer, Albert M. Hyde, Leslie Lodder, G. Schmerling, S. J. Scouse, Alfred J. Smith, Peter G. T. Smith, Robert W. Taylor, M. Berger, H. L. Bache, Berger H. Camille

Resignations

COLUMBUS BRANCH: Paul D. Miller

DAYTON BRANCH: John W. Albaugh

DETROIT BRANCH: J. H. Monaweck

MILWAUKEE BRANCH: John Beyerstedt

ST. JOSEPH VALLEY BRANCH: M. S. Siddell

SYDNEY BRANCH: C. Hughes

TOLEDO BRANCH: Marion Ely

Deaths

NEW HAVEN BRANCH: Thomas J. Brosnan

PHILADELPHIA BRANCH: George Gehling

SUSTAINING MEMBERS

Weirton Steel Company, Weirton, W. Va., was inadvertently omitted from the list of sustaining members in the February issue. We regret this error.

A. E. S. Publications

"The Fundamentals of Electrochemistry and Electrodeposition" by Samuel Glasstone. Price $2.50.

Twenty authoritative chapters in simple language on the properties of solutions, Faraday's Laws, pH, electrode potentials, overvoltage, polarization, anode behavior, corrosion, etc.

Proceedings of the American Electroplaters Society Vol. 33, 1946. Price $6.50.

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35th Annual Convention American Electroplaters' Society

JUNE 28–JULY 1, 1948

The Newark Branch reports substantial progress in its plans for the 35th A. E. S. Convention of which it is host.

There will be about eighteen papers at the regular technical sessions and a series of short reports at a special session devoted to A. E. S. research activities. The time for presentation of each paper will be limited to that necessary to give the essentials, thereby leaving adequate time for pertinent discussion.

The sale of booths in the Industrial Finishing Exposition has progressed most satisfactorily, there being only a limited number of choice locations left. A large variety of equipment and supplies for polishing and buffing, plating, lacquering, and other surface finishing will be shown, some in actual operation; in all an unexcelled opportunity for the purchasing agent, the engineer and the plater to weigh and compare the applicability of competing products to his particular problem.

Among social activities should be mentioned the evening's entertainment sponsored by the International Fellowship Club, an organization of representatives of the suppliers to the industry; the Aunt Ella Party for the ladies promised by Oakite Products, Inc.; and last but not least the banquet with a de luxe dinner, a show of headline acts, and continuous dance music afterwards.

A special program is being arranged for the ladies by Mrs. A. P. Munning and Mrs. Catherine Smith which bids fair even to surpass many such programs of the past.

Perhaps most important are the periods of leisure between activities when old friends meet, new friends are made, and problems can be batted around. The excellent facilities in the hotels and the Convention Hall, on the boardwalk or the sand of the beach will make these periods especially worthwhile. Because that is what Atlantic City is, an ideal convention city, a healthful vacation spot, and an important entertainment center; day or night there is something to satisfy any taste and to suit any purse.

WILLIAM F. BRUHNS,
Publicity Committee.

New A.E.S. Branch Formed

A petition for a temporary charter by the "Louisville Branch" of the American Electroplaters' Society accompanied by the signatures of twenty-two persons, eight of whom are members of the Society, has been received by the Executive Secretary.

It was granted by unanimous action of the Executive Board during its meeting on February 7 and 8.

The new branch should fill a real need in both Louisville, Ky., its headquarters, and the area surrounding it. Our best wishes go to the founders for continued success in their important undertaking.

A. E. S. Board Meeting

The Executive Board of the A. E. S. held a two-day meeting, February 7 and 8, at the Benjamin Franklin Hotel in Philadelphia. D. X. Clarin, Chairman of the Public Relations Committee, attended Saturday morning by invitation and developed further with the Board his plans and program for carrying out this very important new activity of the Society. Through his efforts and the cooperation of the officers and members of the Society, it is hoped to greatly improve the publicity efforts. More information on this matter will be forthcoming in the near future.

George Wagner, Chairman of the Industrial Finishing Exposition Committee for the Atlantic City Convention, also attended the Board meeting by invitation. He reported that over 60 per cent of the Exposition space has already been sold and assured the Board that this year's Show would be a success.

The Milwaukee Convention Committee presented, through the Executive Secretary, an excellent report on the plans that they have already laid for the 1949 Convention. It is a credit to the Milwaukee Branch that they have such a conscientious and enthusiastic group in charge of this important activity.

The Executive Board was unanimous in expressing their approval of the new size publication and reported that the publication is being enthusiastically received by the members.

The Board devoted a great deal of time to the discussion of the future growth and development of the Society. This included the improvement of the annual *Proceedings*, the development of a Plating Handbook, further improvement of the magazine PLATING, and plans for continuing the Industrial Finishing Exposition in future years.

A. KENNETH GRAHAM,
Executive Secretary.

A.E.S. Emblems

Membership pins and buttons, Branch Past-President's buttons, and A. E. S. Past-President's buttons are now available. *The price is $1.20 each.*

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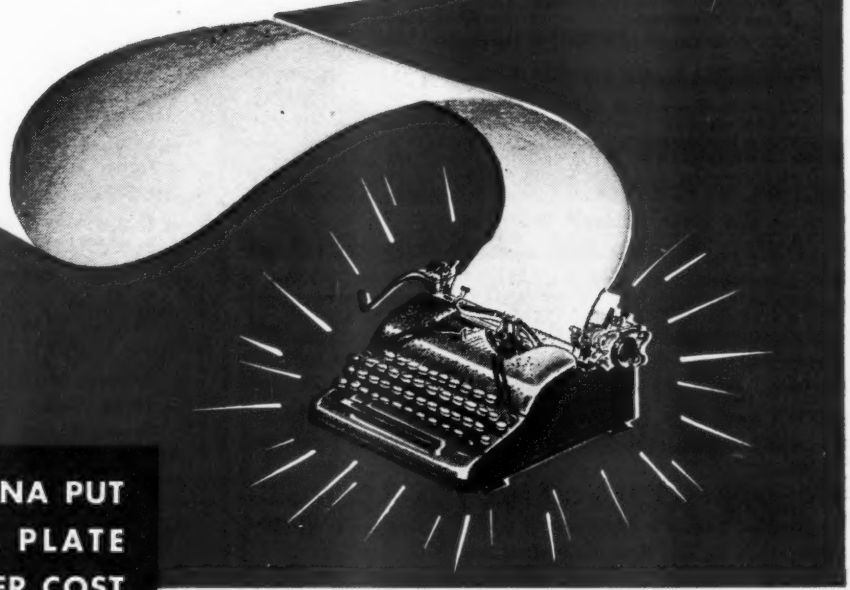

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BALTIMORE-WASHINGTON meets first Tuesday of October, December, February and April at National Bureau of Standards, Washington, D. C., and of November, January, March and May at American Hammered Piston Ring Company, Baltimore, Md. Secretary, Grace Riddell, Chemistry Division, National Bureau of Standards, Washington 25, D. C.

BOSTON meets first Thursday of each month in Hotel Statler. Secretary, Dr. George P. Swift, 53 Galen Street, Watertown 72, Mass.

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CHICAGO meets second Friday of each month at 8 P. M. in Atlantic Hotel. Secretary-Treasurer, J. M. Andrus, 3701 Ravenswood Avenue, Chicago 13, Ill.

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(Continued on page 303)

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(*Continued from page 302*)

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Electroplating from Fluoborate Solutions

(Continued from page 254)

For more precise work, we have found that a platinum electrode in a quinhydrone-containing test solution connected to a calomel electrode by a potassium chloride bridge is satisfactory when arranged as shown in Fig. 4. The rubber cap (a laboratory "policeman")

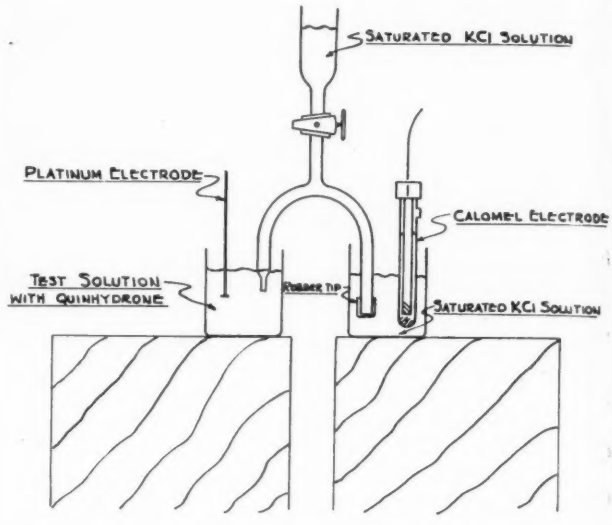

Fig. 4. Equipment for pH determination in copper fluoborate solution

on the one moistened leg of the Y gives a conducting path through the surface film of solution but prevents flow of solution. The fine tip on the other leg permits flushing of the tip at the time of taking readings to remove the plug of potassium fluoborate which forms.

In taking a *p*H reading, the pinhole tip of the bridge is flushed with a few drops of the saturated potassium chloride solution from the reservoir. The test solution containing quinhydrone is brought up around the tip and the platinum electrode, and a reading is taken immediately. The first reading should be the correct one; if the *p*H tends to drop, the reading can be checked by stirring the solution or by flowing a drop or two of solution through the tip of the Y. After removal of the test solution, the bridge tip and electrode should be rinsed, the tip flushed with a few drops of solution, and the tip capped or immersed in potassium chloride solution unless it is to be used within a short time.

Grain Size and Type of Plate

Photomicrographs indicate that deposits from the fluoborate baths have finer grain structure than those from a sulfate bath. At high current densities, nodules and roughness tend to result in the case of thick deposits, but some improvements are possible by use of interrupted or periodic reverse current plating.

With these data at hand, it should be possible to evaluate the factors involved in economical use of fluoborate solutions, balancing higher bath and power costs against higher current densities and consequent smaller equipment.

Index To Advertisers

ABBOTT BALL COMPANY 265
Agency: R. H. Young and Associates
ALLIED RESEARCH PRODUCTS, INC. 270
Agency: The Emery Advertising Co., Inc.
ALSOP ENGINEERING CORPORATION 234
AMERICAN BRASS COMPANY, THE 208
Agency: Ellington and Company, Inc.
AMERICAN BUFF COMPANY 282, 283
Agency: Sydney S. Lovitt Company
AMERICAN CHEMICAL PAINT COMPANY 216
Agency: May Advertising Company
AMERICAN ELECTROPLATERS' SOCIETY 298, 303
APOTHECARIES HALL COMPANY 268
Agency: Edward Owen and Company
AUTOMOTIVE RUBBER COMPANY 227
Agency: Burke Bartlett Company

BAKER, M. E., COMPANY 303
BELKE MANUFACTURING COMPANY 222
Agency: Allbright Associates
BLAKESLEE, G. S., COMPANY 220
Agency: Laueson and Salomon

CHEMICAL CORPORATION 212, 299
Agency: William B. Remington, Inc.
CODMAN, F. L. AND J. C., COMPANY 277
Agency: Sanderson Brothers
COLUMBIA ELECTRIC MANUFACTURING CO. 284
Agency: Geer-Murray Company
COWLES DETERGENT COMPANY 223
Agency: The Bayless Kerr Company

DARCO CORPORATION 231
Agency: Aitkin-Kynett Company
DIVERSEY CORPORATION 288
Agency: Cruttenden and Eger
DIVINE BROTHERS 289
DULUTH BUFF COMPANY 211
DU PONT DE NEMOURS AND COMPANY, INC., E. I. 219
Agency: Batten, Barton, Durstine and Osborn

ENTHONE, INC. 207
Agency: Peck Brothers

GENERAL CHEMICAL DIVISION 209
Agency: Atherton and Currier
GENERAL ELECTRIC CORPORATION 273
Agency: G. M. Basford Company
GREEN, W., ELECTRIC COMPANY, INC. 256
Agency: Shappe-Wilkes, Inc.
GUMM CHEMICAL CO., FREDERICK ..... Second cover

HAMMOND MACHINERY BUILDERS, INC. 255
Agency: Crescent Advertising Service
HANSON-VAN WINKLE-MUNNING CO. ..... Fourth cover
Agency: O. S. Tyson & Company, Inc.
HARRISON AND COMPANY 228
Agency: The Mike Goldcar Company, Inc.
HARSHAW CHEMICAL COMPANY, THE 251
HAY COMPANY, JACOB 230
HULL COMPANY, R. O. 269
Agency: Ralph M. French Advertising

INDUSTRIAL FILTER AND PUMP MFG. CO. 221
Agency: H. C. Boggs Company

JACKSON BUFF COMPANY 224, 225
Agency: Edward Owen & Company

K. & R. INDUSTRIES 303
Agency: Rudolph Greiser Advertising
KIRK AND BLUM MANUFACTURING CO. 284
Agency: J. C. Baer Company

KOCOUR COMPANY 274

LASALCO, INC. 266
Agency: Charles W. Bolan Advertising
LEA MANUFACTURING COMPANY 258, 259
Agency: Sanger-Funnell, Inc.

MAAS AND WALDSTEIN COMPANY 215
Agency: Doyle, Kitchen and McMormick, Inc.
MAC DERMID, INC. ..... Third Cover
Agency: Philips Webb Upham & Company
MAGNUSON PRODUCTS CORPORATION 271
Agency: George Wilfred Wright Advertising
McGEAN CHEMICAL COMPANY, THE 229
Agency: Gates-Bourgeois Advertising Agency
MEAKER COMPANY, THE 279
Agency: The Advertising Corporation
MICHIGAN ABRASIVE COMPANY 304
Agency: Dudgeon, Taylor & Bruske, Inc.
MICHIGAN BUFF COMPANY, INC. 287
MILLER COMPANY, J. C. 247
Agency: James Phillip Reed Advertising
MINNESOTA MINING COMPANY 217, 293
Agency: Batten, Barton, Durstine & Osborn
MITCHELL-BRADFORD CHEMICAL COMPANY. 275
Agency: Claude Schaffner Advertising
MUTUAL CHEMICAL COMPANY OF AMERICA 291
Agency: The House of J. Hayden Twiss

NELSON CHEMICALS CORPORATION 264
Agency: Beckman and Beerbohm, Inc.
NOBLES ENGINEERING & MFG. CO. 272
NORTHWEST CHEMICAL COMPANY 213
Agency: Hyatt Eby Advertising

OAKITE PRODUCTS, INC. 278
Agency: Rickard & Company

PENNSYLVANIA SALT MANUFACTURING CO. 301
Agency: Geare-Marston Advertising
PHILLIPS MANUFACTURING COMPANY 280
Agency: M. C. Lawrence Advertising Co.
PROMAT DIVISION, POOR & COMPANY. 300
Agency: Spaulding Advertising Service

RICHARDSON-ALLEN CORPORATION 276
Agency: E. M. Freystadt Associates, Inc.

SEELEY COMPANY, INC., E. E. 280
SIEFEN, J. J., COMPANY 210
Agency: Kyes and Speckman
SPARKLER MANUFACTURING COMPANY. 292
Agency: Kreicker and Meloan, Inc.
STANDARD PLATING RACK COMPANY 290
Agency: Almon Brooks Wilder Company
STEVENS, INC., FREDERIC B. 232
STORTS WELDING COMPANY 226
SULPHUR PRODUCTS COMPANY 230

UDYLITE CORPORATION, THE 241
Agency: Grant Advertising, Inc.
UNITED CHROMIUM, INC. 214, 296
Agency: Rickard and Company
U. S. STONEWARE 285
Agency: Ralph Gross Advertising

WAGNER BROTHERS 228
Agency: Karl G. Behr Agency
WYANDOTTE CHEMICALS CORPORATION 218
Agency: N. W. Ayer, Inc.

ZIALITE CORPORATION 272

Plating

March 1, 1948

Dear Reader—

The new PLATING is causing much comment, and we're happy to report that it is all favorable.

Many congratulatory letters have crossed my desk during the past few weeks. "The name is better, the size is better, it looks better . . ." says one.

Some of the other comments are. . . "a very attractive publication", "reflects considerable improvement", "excellent job both physically and editorially", "a distinct improvement", "like the way you have punched up the type size—easy reading, easy assimilation!", "doing the industry as a whole a great service", "remodeling job is excellent and the new features are added attractions", "very favorably impressed", "well planned and well done", "readability is greatly improved", "fine example of excellent work and planning", "reaction to the book is extremely favorable", "lends itself to easy cataloging and filing for future reference", "a real magazine capable of fully representing a growing industry."

Remarks such as the above are extremely gratifying. Our sincere efforts to make PLATING an attractive and useful a publication to you, the reader, are well rewarded by these congratulatory messages.

Sincerely,

Gustaf Soderberg

Editor

FUTURE MEETINGS

NEWARK BRANCH, A. E. S. Spring Educational Session, a Symposium on Barrel Finishing, in Robert Treat Hotel on March 5.

LOS ANGELES BRANCH, A. E. S., in Los Angeles Breakfast Club, 3201 Los Feliz Drive on March 20. Annual Educational Session from 10:00 A. M. to 4:00 P. M., Dinner-Dance at 7:30 P. M.

CHICAGO PRODUCTION SHOW in Stevens Hotel on March 22–24, sponsored by Chicago Technical Societies Council, 53 W. Jackson Boulevard, Chicago 4, Ill.

ROCKFORD BRANCH, A. E. S. Annual Educational Session and Banquet in Faust Hotel on April 3, at 1:30 P. M. and 7:00 P. M. respectively.

THIRD SOUTHERN MACHINERY AND METALS EXPOSITION in Atlanta Municipal Auditorium, Atlanta, Ga., on April 5 to 8.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS. Annual Conference and Exhibition in Jefferson Hotel, St. Louis, Mo., on April 5 to 8.

THE ELECTROCHEMICAL SOCIETY. Spring Conference in Deshler-Wallick Hotel, Columbus, Ohio, on April 14 to 17.

BOSTON BRANCH, A. E. S. Annual Educational Session and Banquet, on April 17.

AMERICAN CHEMICAL SOCIETY. 113th National Meeting on April 19 to 23 in Chicago, Ill.

ROCHESTER BRANCH, A. E. S. Spring Educational Meeting on April 24.

MILWAUKEE BRANCH, A. E. S. Annual Educational Meeting and Banquet in Schroeder Hotel on April 24, at 2:00 P. M. and 7:00 P. M., respectively.

NIAGARA FALLS REGIONAL MEETING, A. E. S., auspices Toronto Branch, in General Brock Hotel, Niagara Falls, Ontario, on May 15. Educational Session at 2:30 P. M., Banquet at 6:30 P. M.

INDIANAPOLIS BRANCH, A. E. S. Spring Dinner-Dance in Indianapolis Athletic Club, on Saturday, May 22.

AMERICAN SOCIETY FOR TESTING MATERIALS. Annual Meeting and Eighth Exhibit of Testing Equipment and Related Apparatus in Book-Cadillac Hotel, Detroit, Mich., on June 21 to 25.

AMERICAN ELECTROPLATERS' SOCIETY, 35th Annual Convention and Industrial Finishing Exposition in Ambassador Hotel and Atlantic City Convention Hall, Atlantic City, N. J., on June 28 to July 1.

THE ELECTROCHEMICAL SOCIETY. Fall Conference in Hotel Pennsylvania, New York City, on October 13 to 16.